

CAIS STANDARD MANUAL

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SYSTEM NO. 13 GROUNDS AND MISCELLANEOUS STRUCTURES

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Scientific and Technical
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13 GROUNDS AND MISCELLANEOUS STRUCTURES

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13 GROUNDS AND MISCELLANEOUS STRUCTURES

ABSTRACT

GENERAL ORGANIZATION

At this installation the list of facilities to be surveyed will be addressed on the basis of 32 unique systems that form the CAIS Engineering Deficiency Standards and Inspection Methods document. Each system deals with a specific technical aspect of the facility to be surveyed. Within each system a further breakdown is made to subsystems, each having a specific list of components. Specific observations of the listed defects are provided so as to allow the entry of observed quantification data. A DOD CAIS manual is provided for each of the 32 systems with an internal organization as outlined below:

INSPECTOR'S GUIDE

I. General

- A. Level I Inspection Method Description
- B. Level II Inspection Method Description
- C. Level III Inspection Method Description

II. General Inspection

- A. Process. This section describes the process of the inspection activity.
- B. Location. This section describes the procedure for locating the inspection units in the facility or infrastructure on this installation.

III. Inspector Qualifications

This section notes the minimum qualifications for the person or persons performing the survey.

IV. Inspection Unit

This section describes how the IU (Inspection Unit) is determined for the particular component being surveyed.

V. Unit Costs

This section notes the nature of repair costs for this system.

VI. Standard Safety Requirements

This section lists safety procedures and equipment required to implement a safe environment for the conduct of this survey.

VII. Standard Tools

This section lists a set of standard tools required for the general conduct of this survey.

VIII. Special Tools and Equipment Requirements

This section refers to special tools or equipment requirements endemic to the nature of the system being surveyed.

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IX. Level II Inspection Method Keys

This section explains the use of keys as they relate to Level II Guide Sheets.

X. Level III Inspection Method Keys

This section explains the use of keys as they relate to Level III Guide Sheets.

XI. Replacement Cost

This section describes the nature and location of replacement cost data.

XII. Appendices

Appendix A. Provides a listing and definition of all abbreviations used both in the Standards and in the data base.

Appendix B. Provides a glossary of terms with their definitions as used in the Standard.

Appendix C. This section contains a listing of the average life cycle durations for each assembly* in the Standard.

- * Assembly is a term describing the level at which replacement rather than repair occurs. This can be at the subsystem or component designation, depending on the system being surveyed.

SYSTEM TREE

The System Tree is a graphical representation of the Work Breakdown Structure, showing system, subsystem and component relationships for the Grounds and Miscellaneous Structures.

INSPECTION METHODS

Description

Describes the nature of what is to be condition surveyed.

Special Tool and Equipment Requirements

Lists any special tools required for this specific subsystem.

Special Safety Requirements

This section outlines any special safety measures or equipment required for this specific subsystem so as to maintain a safe environment and process in the conduct of the condition survey.

Component List

All components to be surveyed under this subsystem are listed here.

Related Subsystems

All other subsystems that have a survey relationship to this subsystem are listed here to help coordinate a complete and thorough condition assessment survey.

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Standard Inspection Procedure

This statement indicates the various levels of survey effort required for this subsystem.

Components

The previously listed components of this subsystem are described with a survey procedure recommended on a component by component basis. For each component there is a listing of defects with each defect broken down into observations describing the nature and severity of the defective condition observed. The surveyor enters a quantification value for each defect/observation encountered in the field CAIS device (DCD) to record the result of his survey.

References

This page lists the reference sources from which the foregoing subsystem data was developed.

Guide Sheet Control Number

This section lists the key numbers that tie the written Level II and Level III guide sheets to specific components in this subsystem.

Level II and Level III Inspection Method Guide Sheets

This section contains the detailed descriptions of the Level II and III survey and inspection procedures for this subsystem.

13 GROUNDS AND MISCELLANEOUS STRUCTURES

INSPECTOR'S GUIDE

I. GENERAL

A. Level I Inspection Method

The Level I Inspection Method of grounds and miscellaneous structures consists of a thorough inspection of each subsystem and component as described in the Work Breakdown Structure. The survey activity is designed to be performed by a single surveyor.

B. Level II Inspection Method

Level II inspections are triggered by defect/observations noted at the Level I inspection or in some cases, are required to conduct a meaningful survey of the component being inspected. The Grounds and Miscellaneous Structures require very few Level II inspections, since most defects are readily apparent from a Level I. The majority involve the inspection of deterioration, fungi decay or parasite damage to wood components. Level II inspections are referenced by defect/observations through a "Level II key", which denotes a specific Guide Sheet that describes the Level II inspection activity.

C. Level III Inspection Method

The Level III inspection is triggered by defect/observations occurring in the Level I and II inspections. The Level III inspection can also occur as a result of time based scheduling, antidotal experience, or component age compared to its life cycle. The Level III inspection is referenced through a Level III key which in turn, denotes a specific Guide Sheet describing the Level III inspection process and requirements. Level III inspections produce a detailed, written engineering assessment of the deficiency along with an estimated cost of correction, and are performed at the option of the Facility Manager.

II. GENERAL INSPECTION

A. Process

Surveys are normally conducted at the component level. Figure 13-A provides the breakdown from system through component for the Grounds and Miscellaneous Structures. The surveyor will work through the Work Breakdown Structure (WBS) to conduct the inspection. At the component level the surveyor will be provided a list of defects, each of which is described further in detail as observations. These observations are described to various levels of severity as they relate to the effect of the life of the system. The quantification of each deficiency is identified by the surveyor using the associated unit of measure. Once an observation is populated with a deficient quantity, the inspector will be requested to provide information on the component type and location. The installation date or age of the component may be preloaded into the WBS for each asset from the Real Property Inventory List or site

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specific information. If necessary, age data can be overridden by the surveyor, Site CAIS personnel, or the Facility Manager.

B. Location

Level I and II inspections will be located by the surveyor through a discrete entry in the Field CAIS. Plans, sketches and/or maps are required to ensure a complete inspection of all areas and to assist in the location of IU's. The inspection team members must use the recommended numbering schemes for the installation. The installation may have areas physically identified by a numbering system or identified on the plans. If both exist and are different, the Facility Manager will develop guidance on which numbering system takes precedence. Where numbering systems do not exist or are not complete in identifying each area, specific guidance for the inspector to annotate areas in a consistent manner should be developed by the Facility Manager and implemented in the installations CAS process. In all cases, plans and maps shall be orientated with the top of each sheet being the north direction, so as to allow directional location and description. In the case where no other means of location exist the inspector shall enter a brief (65 character) description of location. Locations must be accurate to insure future repeatability and consistent results.

III. INSPECTOR QUALIFICATIONS

The minimum inspector qualification for the Grounds and Miscellaneous Structures requires a five year journeyman. All of the condition survey requirements for this system can be accomplished at the Level I inspection by a single inspector, however, safety and other considerations may require that inspectors work in teams. Inspectors will be specifically trained in the CAS system and its usage and will be CAS certified in the "Civil" and "Mechanical" disciplines.

IV. INSPECTION UNIT (IU)

The Inspection Unit (IU) is normally defined at the component level for this system. The varied configurations of the components that exist in the Grounds and Miscellaneous Structures require that they be evaluated differently when defining the IU. Therefore, the measurement technique requires some consideration. If the inspector finds multiple defects that occur on the same IU, the inspector will quantify the observation that is considered most severe and identify the remaining quantity under the less severe observation for the discrete component.

In order to reduce the overall time required to perform inspections, the CAS program may include representative or random selection of IU's for some subsystems in the Site Work System.

- Fencing

Because of the various types and extensive total length of fencing found on an installation, a statistical sampling plan for inspecting the fence assets should be prepared. The selection of fence units to inspect should provide

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a 95 percent confidence level in determining the overall condition of the installation's fencing. To select the fence units to be inspected, each type of fence should be divided into management units. A management unit is defined as a logical division of fencing, such as a continuous length of fence, or the length between directional changes when bordering an installation. Each management unit is then divided into the individual fence inspection units (IU's). The following table lists the minimum number of fence IU's that should be inspected in each management unit. If the fence IU's in each type of fence are numbered consecutively, a table of Random Numbers (as found in NAVFAC MO-326-1, Quality Assurance Evaluation Training Manual) can be used to randomly select the fence IU's to be inspected.

| IU's/Management Unit | IU's to Inspect |
|----------------------|-----------------|
| 1-10 | 2 |
| 11-25 | 3 |
| 26-40 | 4 |
| over 40 | 10% |

Additional fence IU's may be selected and inspected if the inspector determines that non-represented defects are present in management units where no IU's were inspected.

- **Cemeteries**

Because of the large numbers of grave sites, monuments, head and foot stones that large cemeteries contain, a statistical sampling plan should also be prepared for inspecting these assets, to provide a 95 percent confidence level of determining the overall condition of the cemetery's total assets, 10 percent of the grave sites and associated markers should be inspected. By sequentially numbering the grave sites, a table of Random Numbers (as found in NAVFAC MO-326-1, Quality Assurance Evaluation Training Manual) can be used to randomly select the individual grave sites (IU's) and associated markers to be inspected.

The IU's for the most common components would be defined as follows:

- Fence Panel, Gate and Retaining Wall IU's are defined by the square footage of the section the defect is affecting. This can be calculated by multiplying the height of the fence, gate or wall by the length of the section. A section is defined by breaks in continuity (i.e., structural supports, directional changes in the plane of the fence, etc.).
- Security Wire IU's are defined by the length (LF) of the wire between posts.
- Fence Post, Flagpole IU's are defined by the entire length (LF) of the post or pier.

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- Deck, Surface, Flooring, Framing and Coping IU's - The square footage of the surface, defined by joints or directional changes in the plane of the surface.
- Pool Hardware IU, Circulating Pump IU, etc. - Singularly defined items such as these are defined as each.

V. UNIT COSTS

The unit costs that are applied to the quantities recorded for each observation are contained within the Site CAIS as repair cost.

VI. STANDARD SAFETY REQUIREMENTS

The Master Safety Plan will be followed at all times during the condition survey.

Inspector may utilize the following protective gear:

- Hard hat - to be worn during all surveys
- Safety glasses - to be worn during all surveys
- Safety shoes - to be worn during all surveys
- Coveralls - to be worn as necessary
- Gloves - to be worn as necessary
- Ear plugs - to be worn in designated areas
- Knee pads - to be worn when crawling is required
- Rain suit - to be worn as necessary
- Wet suit - to be worn as necessary

VII. STANDARD TOOLS

Employee Identification Card - to be worn or carried during all survey activities
Data Collection Device (DCD)
Battery pack for DCD
Flashlight
Measuring tapes (12-ft. and 100-ft.)
Screwdrivers - Phillips and straight slot
Pliers
Pocket knife or ice pick
Scraper
Wire brush
Hammer (for sounding)
Calipers
Measuring scales

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VIII. SPECIAL TOOLS AND EQUIPMENT REQUIREMENTS

At the subsystem level, the deficiency standard has identified special tools and equipment required for the standard inspection of the associated components, which exceed the standard tools identified for the system. Level III Inspection Method Guide Sheets will address additional tools and equipment requirements that are specific to that particular advanced method of inspection.

Facility Managers should review these sections in order to determine any special tool requirements for subsystems they are to inspect/survey.

IX. LEVEL II INSPECTION METHOD KEYS

Certain observations will reference a Level II Inspection Method. The Facility Manager will be able to identify deficiencies where a Level II inspection is flagged. The Level II key at the observation level will refer to a specific guide sheet.

All Level II Guide Sheets are located at the end of each Subsystem section. A Guide Sheet Reference page precedes Level II and Level III Guide Sheets.

X. LEVEL III INSPECTION METHOD KEYS

Certain observations will trigger a Level III inspection. The Facility Manager will be able to identify deficiencies where a Level III inspection is flagged. The Level III Key at the observation level will refer to a specific guide sheet. These guide sheets may refer the Facility Manager to a more sophisticated and costly test method.

All Level III Guide Sheets are located at the end of each Subsystem section. A Guide Sheet Reference page precedes Level II and Level III Guide Sheets.

XI. REPLACEMENT COST

A replacement cost for each subsystem type will be contained within the cost estimating system in the Site CAIS.

XII. APPENDICES

Appendix A - Abbreviations

A summary and definition of all abbreviations used in this system are contained in Appendix A which is located at the end of Grounds and Miscellaneous Structures.

Appendix B - Glossary

A glossary of terms used in this system are contained in Appendix B which is located at the end of Grounds and Miscellaneous Structures.

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Appendix C - Life Cycles

A listing of the average life cycle duration for each assembly* in the Standard.

Note - Facility Manager's Guide

The following are included in the Facility Manager's Guide:

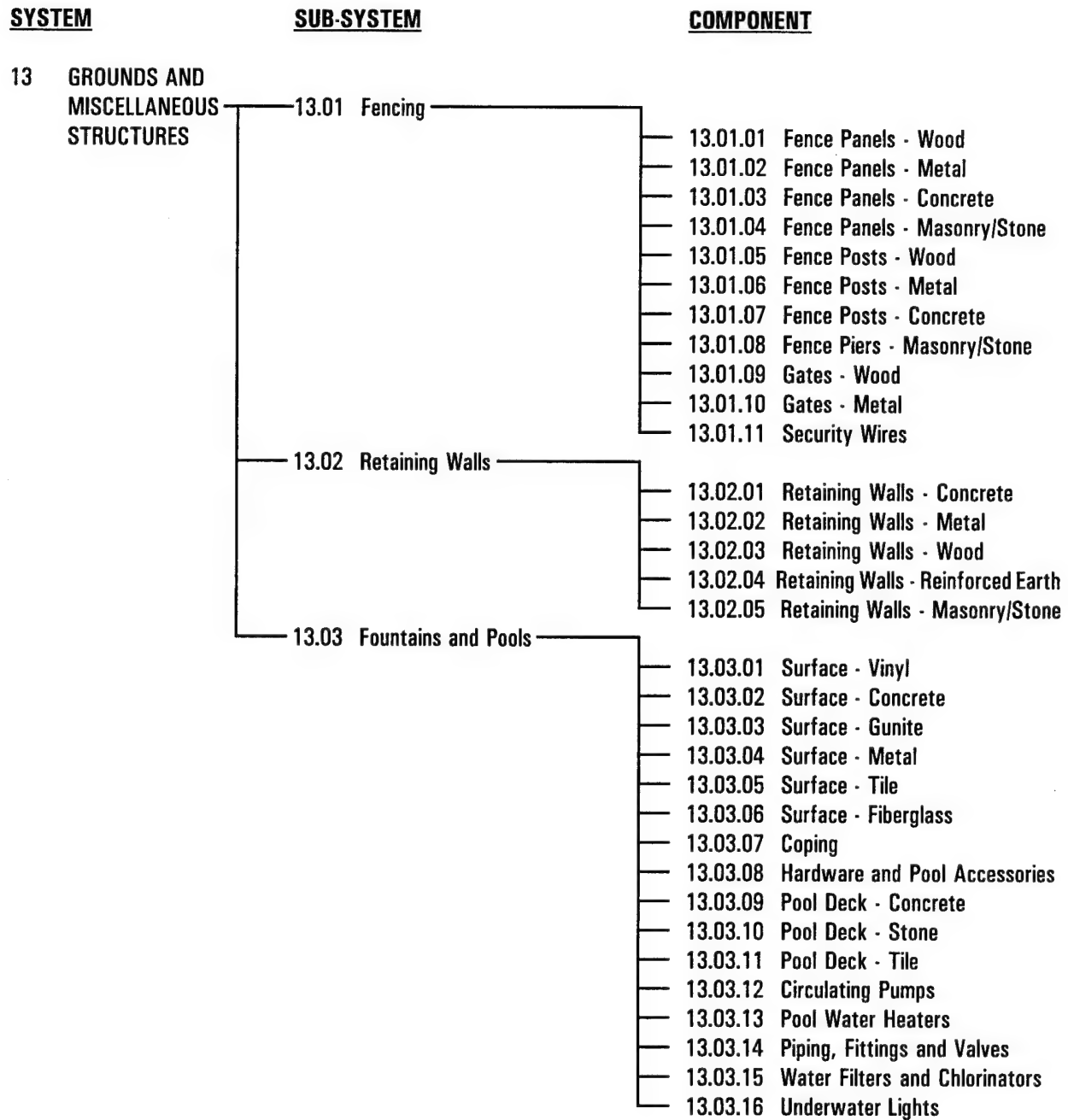
A table showing the required manhours to perform the standard inspection for this facility listed by Cat Code (three digit).

A listing of all Level III inspections with their estimated cost and time to perform. This list will include frequency of inspections for time driven Level III's.

* Assembly is a term describing the level at which replacement rather than repair occurs. This can be at the subsystem or component designation, depending on the system being surveyed.

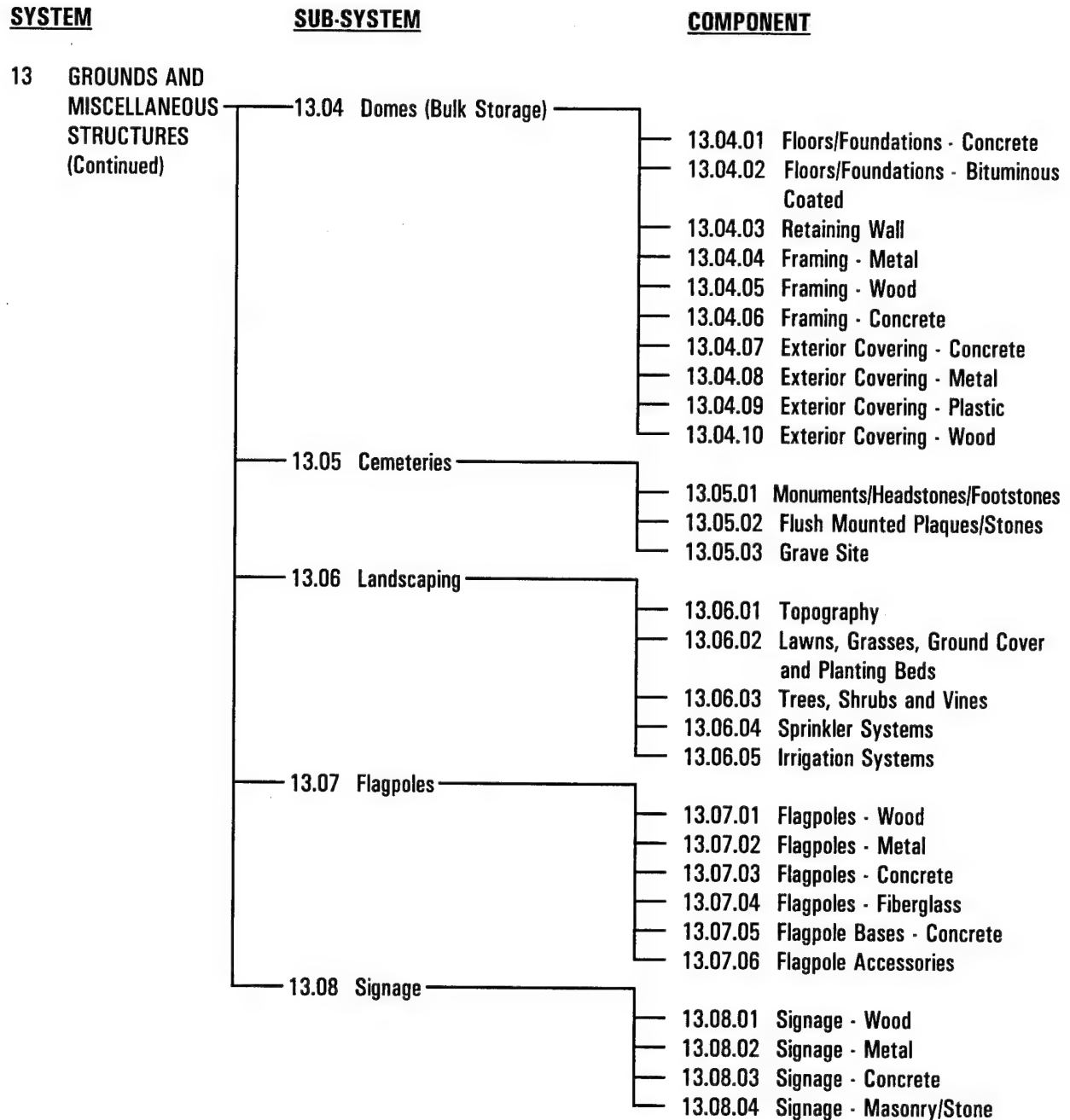
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Figure 13-A. WORK BREAKDOWN STRUCTURE



13 GROUNDS AND MISCELLANEOUS STRUCTURES

Figure 13-A. WORK BREAKDOWN STRUCTURE (Continued)



13.01 FENCING

DESCRIPTION

Fencing is a subsystem of the Grounds and Miscellaneous Structures System. Fences serve as enclosures, barriers or boundaries, usually constructed with wood, metal, concrete, masonry or stone. Gates are structures that may be swung, drawn, rolled or lowered across an opening to permit egress. For increased protection, security wire may be attached at the top of the fence.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Fencing:

1. Scraper
2. Brush
3. Ice pick or pocket knife
4. Hammer
5. Calipers
6. Measuring scale

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Fencing, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- ◆ 13.01.01 FENCE PANELS - WOOD
- ◆ 13.01.02 FENCE PANELS - METAL
- ◆ 13.01.03 FENCE PANELS - CONCRETE
- ◆ 13.01.04 FENCE PANELS - MASONRY/STONE
- ◆ 13.01.05 FENCE POSTS - WOOD
- ◆ 13.01.06 FENCE POSTS - METAL
- ◆ 13.01.07 FENCE POSTS - CONCRETE
- ◆ 13.01.08 FENCE PIERS - MASONRY/STONE
- ◆ 13.01.09 GATES - WOOD
- ◆ 13.01.10 GATES - METAL
- ◆ 13.01.11 SECURITY WIRES

RELATED SUBSYSTEMS

There are no related subsystems.

13.01 FENCING

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspector's Data Collection Devices.

COMPONENTS

◆ 13.01.01 FENCE PANELS - WOOD

A wood fence consists of a line of posts with wood railing, pickets, planks, braces and other fence wall members securely nailed in place. Fences out of plumb may be checked by eye sight, string line, or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Splits/cracking/broken. | | | |
| Observation: | | | |
| a. Surface fibers separated extending over entire member, less than 25 percent of thickness affected. | SF | | |
| *** {Severity M} | | | |
| b. Surface fibers separated extending over entire member, greater than 25 percent of thickness affected. | SF | | |
| *** {Severity H} | | | |
| c. Physically damaged and broken. | SF | | |
| *** {Severity H} | | | |
| * Rot, fungus or decay. | | | |
| Observation: | | | |
| a. Moist stained area. | SF | | |
| *** {Severity M} | | | |
| b. Discolored, soft or crushed area. | SF | 1 | |
| *** {Severity H} | | | |
| * Parasite damage. | | | |
| Observation: | | | |
| a. Holes less than 1/8" DIA, surface sag, and frass observed. | SF | 1 | |
| *** {Severity M} | | | |
| b. Large holes greater than 1/8" DIA, surface channels, punctures, and crushing. | SF | 1 | |
| *** {Severity H} | | | |

13.01 FENCING

COMPONENTS (Continued)

◆ 13.01.01 FENCE PANELS - WOOD (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Out of plumb. | | | |
| Observation: | | | |
| a. More than 3" in 8'. | SF | | |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion under fence wall. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or | SF | | |
| growing into fence. | | | |
| *** {Severity M} | | | |

13.01 FENCING

COMPONENTS (Continued)

◆ 13.01.02 FENCE PANELS - METAL

A metal fence consists of a line of posts, with pipe railing, braces, wire, fence fabric tension bars and metal wire ties. Metal fence fabric wall may be chain link, mesh, welded wire, woven wire or metal cables. Metal panels may be preformed or combined and laced in fabric. Fences out of plumb may be checked by eyesight, string line or transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Defective fence fabric. | | | |
| Observation: | | | |
| a. Loose or sagging fence fabric greater than 2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. Damaged or missing fence fabric. | SF | | |
| *** {Severity H} | | | |
| * Defective fence panels. | | | |
| Observation: | | | |
| a. Loose fence panels. | SF | | |
| *** {Severity M} | | | |
| b. Damaged or missing fence panels. | SF | | |
| *** {Severity H} | | | |
| * Loose connections/anchorage. | | | |
| Observation: | | | |
| a. Loose bolts or wire fasteners. | EA | | |
| *** {Severity M} | | | |
| b. Loose or bent railing. | EA | | |
| *** {Severity H} | | | |
| c. Missing or broken components. | EA | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. More than 3" in 8'. | SF | | |
| *** {Severity H} | | | |

13.01 FENCING

COMPONENTS (Continued)

♦ 13.01.02 FENCE PANELS - METAL (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Corrosion. | | | |
| Observation: | | | |
| a. Missing protective coating-galvanizing/ paint no pitting evident. | SF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | SF | | |
| *** {Severity M} | | | |
| c. Rust/corrosion evidenced loss of base metal. | SF | | |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion under fence wall. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or growing into fence. | SF | | |
| *** {Severity M} | | | |

13.01 FENCING

COMPONENTS (Continued)

♦ 13.01.03 FENCE PANELS - CONCRETE

Concrete fences include cast in place non-reinforced or reinforced concrete strip footing and fence walls. Fences out of plumb may be checked by eyesight, string line or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline cracks to 1/16" wide. *** {Severity L} | SF | | |
| b. Wide cracks more than 1/16" wide. *** {Severity M} | SF | | 1 |
| c. Disintegration of concrete surfaces, with loss of surface exceeding depth of 2". *** {Severity H} | SF | | 1 |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. *** {Severity L} | SF | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. *** {Severity H} | SF | | |
| c. Disintegration of surface area, with corrosion of exposed reinforcing steel. *** {Severity H} | SF | | 2 |
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. *** {Severity L} | SF | | |
| b. Loss of surface from 1/2" to 1" deep with coarse aggregates clearly exposed. *** {Severity M} | SF | | |
| c. Loss of surface exceeds 1", reinforcing steel usually exposed. *** {Severity H} | SF | | 2 |

13.01 FENCING

COMPONENTS (Continued)

♦ 13.01.03 FENCE PANELS - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | SF | | 2 |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. More than 3" in 8'. | SF | | |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion under fence walls. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or growing into fence. | SF | | |
| *** {Severity M} | | | |

13.01 FENCING

COMPONENTS (Continued)

♦ 13.01.04 FENCE PANELS - MASONRY/STONE

Masonry/stone fences normally have a concrete footing to support the brick, CMU or stone fence walls. Fences out of plumb may be checked by eyesight, string line or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Deteriorated mortar joint material. | | | |
| Observation: | | | |
| a. Cracked mortar joint material. | SF | | |
| *** {Severity L} | | | |
| b. Loose/missing mortar joint material. | SF | | |
| *** {Severity H} | | | |
| c. Eroded mortar greater than 1/2" deep. | SF | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. More than 3" in 8'. | SF | | 3 |
| *** {Severity H} | | | |
| * Damage bricks, stones or CMU. | | | |
| Observation: | | | |
| a. Cracked, split, damaged. | SF | | 4 |
| *** {Severity M} | | | |
| b. Loose, missing. | SF | | |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion under fence wall. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or growing into fence. | SF | | |
| *** {Severity M} | | | |

13.01 FENCING

COMPONENTS (Continued)

♦ 13.01.05 FENCE POSTS - WOOD

A wood fence consists of a line of wood posts secured to the ground and connected with wood railing, pickets, planks, braces and other fence wall members securely nailed in place. Posts out of plumb may be checked by eye sight, string line, or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Splits/cracking/broken. | | | |
| Observation: | | | |
| a. Surface fibers separated extending over entire member, less than 25 percent of thickness affected. | SF | | |
| *** {Severity M} | | | |
| b. Surface fibers separated extending over entire member, greater than 25 percent of thickness affected. | SF | | |
| *** {Severity H} | | | |
| c. Physically damaged and broken. | SF | | |
| *** {Severity H} | | | |
| * Rot, fungus or decay. | | | |
| Observation: | | | |
| a. Moist stained area. | SF | | |
| *** {Severity M} | | | |
| b. Discolored, soft or crushed area. | SF | 2 | |
| *** {Severity H} | | | |
| * Parasite damage. | | | |
| Observation: | | | |
| a. Holes less than 1/8" DIA, surface, sag, and frass observed. | SF | 2 | |
| *** {Severity M} | | | |
| b. Large holes greater than 1/8" DIA, surface channels, punctures, and crushing. | SF | 2 | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. More than 3" in 8'. | SF | | |
| *** {Severity H} | | | |

13.01 FENCING

COMPONENTS (Continued)

♦ 13.01.05 FENCE POSTS - WOOD (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion around posts. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or around posts. | SF | | |
| *** {Severity M} | | | |

13.01 FENCING

COMPONENTS (Continued)

◆ 13.01.06 FENCE POSTS - METAL

A metal fence consists of a line of pipe/metal posts, usually set in concrete, connected together with pipe railing, brace railing, braces, wire, fence fabric tension bars and metal wire ties. Metal fence fabric wall may be chain link, mesh, welded wire, woven wire or metal cables. Posts out of plumb may be checked by eyesight, string line or transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Loose connections/anchorage. | | | |
| Observation: | | | |
| a. Loose bolts or wire fasteners. | EA | | |
| *** {Severity M} | | | |
| b. Loose or bent pipe posts or railing. | EA | | |
| *** {Severity H} | | | |
| c. Missing or broken components. | EA | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. More than 3" in 8'. | SF | | |
| *** {Severity H} | | | |
| * Corrosion. | | | |
| Observation: | | | |
| a. Missing protective coating-galvanizing/ paint no pitting evident. | SF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | SF | | |
| *** {Severity M} | | | |
| c. Rust/corrosion evidenced loss of base metal. | SF | | |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion around posts. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or around posts. | SF | | |
| *** {Severity M} | | | |

13.01 FENCING

COMPONENTS (Continued)

◆ 13.01.07 FENCE POSTS - CONCRETE

Concrete fences include cast in place non-reinforced or reinforced concrete strip footing and fence walls. Posts out of plumb may be checked by eyesight, string line or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline crack. | SF | | |
| *** {Severity L} | | | |
| b. Wide cracks more than 1/16" wide. | SF | | 5 |
| *** {Severity M} | | | |
| c. Disintegration of concrete surfaces, with loss of surface exceeding depth of 2". | SF | | 5 |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area, with corrosion of exposed reinforcing steel. | SF | | 6 |
| *** {Severity H} | | | |
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | SF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep with coarse aggregates clearly exposed. | SF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeds 1", reinforcing steel usually exposed. | SF | | 6 |
| *** {Severity H} | | | |

13.01 FENCING

COMPONENTS (Continued)

♦ 13.01.07 FENCE POSTS - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | SF | | 6 |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. More than 3" in 8'. | SF | | |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion around posts. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or around posts. | SF | | |
| *** {Severity M} | | | |

13.01 FENCING

COMPONENTS (Continued)

♦ 13.01.08 FENCE PIERS - MASONRY/STONE

Masonry/stone fences normally have a concrete footing to support the brick, CMU or stone fence walls. Piers out of plumb may be checked by eyesight, string line or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Deteriorated mortar joint material. | | | |
| Observation: | | | |
| a. Cracked mortar joint material. | SF | | |
| *** {Severity L} | | | |
| b. Loose/missing mortar joint material. | SF | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. More than 3" in 8'. | SF | | 7 |
| *** {Severity H} | | | |
| * Damage bricks, stones or CMU. | | | |
| Observation: | | | |
| a. Cracked, split, damaged. | SF | | 8 |
| *** {Severity M} | | | |
| b. Loose, missing. | SF | | |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion around piers. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or around piers. | SF | | |
| *** {Severity M} | | | |

13.01 FENCING

COMPONENTS (Continued)

◆ 13.01.09 GATES - WOOD

Wood gates are constructed with wood rails, pickets, planks, braces and other members securely fastened into a single unit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Defective gate. | | | |
| Observation: | | | |
| a. Surface fibers separated extending over entire member, less than 25 percent of thickness affected. | SF | | |
| *** {Severity M} | | | |
| b. Surface fibers separated extending over entire member, greater than 25 percent of thickness affected. | SF | | |
| *** {Severity H} | | | |
| c. Damaged or missing wood sections. | SF | | |
| *** {Severity H} | | | |
| * Rot, fungus or decay. | | | |
| Observation: | | | |
| a. Moist stained area. | SF | | |
| *** {Severity M} | | | |
| b. Discolored, soft or crushed area. | SF | 3 | |
| *** {Severity H} | | | |
| * Parasite damage. | | | |
| Observation: | | | |
| a. Holes less than 1/8" DIA, surface sag, and frass observed. | SF | 3 | |
| *** {Severity M} | | | |
| b. Large holes greater than 1/8" DIA, surface channels, punctures, and crushing. | SF | 3 | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. More than 3" in 6'. | SF | | |
| *** {Severity H} | | | |

13.01 FENCING

COMPONENTS (Continued)

◆ 13.01.09 GATES - WOOD (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Connections. | | | |
| Observation: | | | |
| a. Loose wood at connection site. | EA | | |
| *** {Severity M} | | | |
| b. Broken, split, or damaged wood at connection site. | EA | | |
| *** {Severity H} | | | |
| c. Missing fasteners or anchorage. | EA | | |
| *** {Severity H} | | | |

13.01 FENCING

COMPONENTS (Continued)

♦ 13.01.10 GATES - METAL

Metal gates are fabricated with pipe/tube framing covered with metal chain link or other woven wire mesh preformed panel or metal laced fabric and kept in shape with wires, rods or turn buckles.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Defective gate fabric. | | | |
| Observation: | | | |
| a. Loose or sagging gate fabric. | SF | | |
| *** {Severity M} | | | |
| b. Damaged or missing gate fabric. | SF | | |
| *** {Severity H} | | | |
| * Defective gate panels. | | | |
| Observation: | | | |
| a. Loose gate panels. | SF | | |
| *** {Severity M} | | | |
| b. Damaged or missing gate panels. | SF | | |
| *** {Severity H} | | | |
| * Loose connections. | | | |
| Observation: | | | |
| a. Loose bolts or wire fasteners. | EA | | |
| *** {Severity M} | | | |
| b. Loose or bent pipe post/bracing. | EA | | |
| *** {Severity H} | | | |
| c. Missing or broken hinges, latches or other components. | EA | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. More than 1/2" in 6'. | SF | | |
| *** {Severity H} | | | |

13.01 FENCING

COMPONENTS (Continued)

♦ 13.01.10 GATES - METAL (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Corrosion. | | | |
| Observation: | | | |
| a. Missing protective coating-galvanizing/ paint no pitting evident. | SF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | SF | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by loss of base metal. | SF | | |
| *** {Severity H} | | | |

13.01 FENCING

COMPONENTS (Continued)

◆ 13.01.11 SECURITY WIRES

Security components such as barbed, razor or concertina wire may be installed around the top of a fence, either directly to the posts or on a metal angle bracket attached to top of the posts.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Loose Connections. | | | |
| Observation: | | | |
| a. Loose brackets or bolts. | EA | | |
| *** {Severity M} | | | |
| b. Missing or broken brackets or bolts. | EA | | |
| *** {Severity H} | | | |
| * Defective wire. | | | |
| Observation | | | |
| a. Loose or sagging wire. | LF | | |
| *** {Severity M} | | | |
| b. Broken or missing wire. | LF | | |
| *** {Severity H} | | | |
| * Corroded wire. | | | |
| Observation: | | | |
| a. Missing protective coating-galvanizing/ | LF | | |
| paint no pitting evident. | | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by loss of base | LF | | |
| metal. | | | |
| *** {Severity H} | | | |
| * Corroded brackets. | | | |
| Observation: | | | |
| a. Missing protective coating-galvanizing/ | EA | | |
| paint no pitting evident. | | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or | EA | | |
| blistering. | | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by loss of base | EA | | |
| metal. | | | |
| *** {Severity H} | | | |

13.01 FENCING

REFERENCES

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

13.01 FENCING

LEVEL II KEY GUIDE SHEET CONTROL NUMBER

| | |
|---|------------------|
| 1 | GS-II 13.01.01-1 |
| 2 | GS-II 13.01.05-2 |
| 3 | GS-II 13.01.09-3 |

LEVEL III KEY GUIDE SHEET CONTROL NUMBER

| | |
|---|-------------------|
| 1 | GS-III 13.01.03-1 |
| 2 | GS-III 13.01.03-2 |
| 3 | GS-III 13.01.04-3 |
| 4 | GS-III 13.01.04-4 |
| 5 | GS-III 13.01.07-5 |
| 6 | GS-III 13.01.07-6 |
| 7 | GS-III 13.01.08-7 |
| 8 | GS-III 13.01.08-8 |

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: FENCE PANELS - WOOD
CONTROL NUMBER: GS-II 13.01.01-1

Application

This guide applies to the investigation (possible deterioration of wood fence panels) of wood fence panels due to rot, fungi decay or parasite damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area, using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer, in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick/pocket knife, to determine extent of damage due to insect infestation, rot or damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: FENCE POSTS - WOOD
CONTROL NUMBER: GS-II 13.01.05-2

Application

This guide applies to the investigation of (possible deterioration of wood fence panels) wood fence posts due to rot, fungi decay or parasite damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area, using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer, in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick/pocket knife, to determine extent of damage due to insect infestation, rot or damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: GATES - WOOD
CONTROL NUMBER: GS-II 13.01.09-3

Application

This guide applies to the investigation of (possible deterioration of wood fence panels) wood gates due to rot, fungi decay or parasite damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area, using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer, in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick/pocket knife, to determine extent of damage due to insect infestation, rot or damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: FENCE PANELS - CONCRETE
CONTROL NUMBER: GS-III 13.01.03-1

Application

This guide applies to the investigation of cracks in concrete fence panels.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: FENCE PANELS - CONCRETE
CONTROL NUMBER: GS-III 13.01.03-2

Application

This guide applies to the investigation of corrosion of exposed reinforcing steel in concrete fence panels.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: FENCE PANELS - MASONRY/STONE
CONTROL NUMBER: GS-III 13.01.04-3

Application

This guide applies to the investigation of out of level or out of plumb brick, CMU block or stone masonry fence panels.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for uneven settlement by observing condition of exterior grade or foundation slab.
2. Check all sealant, expansion/contraction joints or mortar joints for deterioration which can allow water penetration.
3. Perform ultrasonic pulse velocity test to compare structural integrity from one part of the wall to another and identify locations of cracks, breaks and other disintegration that could contribute to out of level or out of plumb walls.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: FENCE PANELS - MASONRY/STONE
CONTROL NUMBER: GS-III 13.01.04-4

Application

This guide applies to the investigation of cracks in brick CMU block or stone masonry fence panels.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check cracks for any stress related condition, construction movement, settlement or overload.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT to determine extent of internal cracking and disintegration, in this case ultrasonic pulse velocity inspection.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: FENCE POSTS - CONCRETE
CONTROL NUMBER: GS-III 13.01.07-5

Application

This guide applies to the investigation of cracks in concrete fence footings and posts.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.
4. If footings are exposed, examine for cracks or breaks and take core samples for analysis to determine condition or strength of the footing.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: FENCE POSTS - CONCRETE
CONTROL NUMBER: GS-III 13.01.07-6

Application

This guide applies to the investigation of corrosion of exposed reinforcing steel in concrete fence footings and posts.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: FENCE PIERS - MASONRY/STONE
CONTROL NUMBER: GS-III 13.01.08-7

Application

This guide applies to the investigation of out of level or out of plumb brick, CMU block or stone masonry fence piers.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for uneven settlement by observing condition of exterior grade or foundation slab.
2. Check all sealant, expansion/contraction joints or mortar joints for deterioration which can allow water penetration.
3. Perform NDT, in this case ultrasonic pulse velocity test to determine structural integrity and identify locations of cracks, breaks and other subsurface disintegration that could contribute to out of plumb piers.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: FENCE PIERS - MASONRY/STONE
CONTROL NUMBER: GS-III 13.01.08-8

Application

This guide applies to the investigation of cracks in brick CMU block or stone masonry fence walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check cracks for any stress related condition, construction movement, settlement or overload.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT to determine extent of internal cracking and disintegration, in this case ultrasonic pulse velocity inspection.
4. If footings are exposed, examine for cracks or breaks and take core samples for lab analysis to determine condition or strength of the footing plug core holes with epoxy sealer after boring.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

13.02 RETAINING WALLS

DESCRIPTION

Retaining Walls is a subsystem of the Grounds and Miscellaneous Structures Systems. Retaining walls are designed to hold earth and other materials in place to prevent slides and displacements. They also assist in the prevention of erosion and the channeling of storm water runoff.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following list of special tools and equipment, beyond the requirements listed in the Standard Tool Section, are to perform the inspection of Retaining Walls:

1. Scraper
2. Brush
3. Ice picker pocket knife
4. Hammer

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Retaining Walls, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- ◆ 0.13.02.01 RETAINING WALLS - CONCRETE
- ◆ 0.13.02.02 RETAINING WALLS - METAL
- ◆ 0.13.02.03 RETAINING WALLS - WOOD
- ◆ 0.13.02.04 RETAINING WALLS - REINFORCED EARTH
- ◆ 0.13.02.05 RETAINING WALLS - MASONRY/STONE

RELATED SUBSYSTEMS

There are no related systems requiring inspection.

13.02 RETAINING WALLS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations, and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

♦ 13.02.01 RETAINING WALLS - CONCRETE

Concrete retaining walls may be installed with or without reinforcement and with or without a concrete footing or metal tieback rods anchored to a "deadman". Weep holes are normally provided for drainage. Walls out of level or out of plumb may be checked by eye sight, a string line between the main corners, or a transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline cracks, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, between 1/16" and 1/4" wide. | LF | | 1 |
| *** {Severity H} | | | |
| d. Extensive disintegration of surface or cracks exceeding depth of 2". | SF | | 1 |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area with corrosion of exposed reinforcing steel. | SF | | 2 |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

♦ 13.02.01 RETAINING WALLS - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. *** {Severity M} | SF | | |
| b. More than 1/2" in 8'. *** {Severity H} | SF | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 8'. *** {Severity M} | SF | | |
| b. More than 3" in 8'. *** {Severity H} | SF | | |
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. *** {Severity L} | SF | | |
| b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed. *** {Severity M} | SF | | |
| c. Loss of surface exceeding 1" deep. *** {Severity H} | SF | | |
| d. Exposure of reinforcing steel. *** {Severity H} | SF | | 2 |
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. *** {Severity H} | SF | | 2 |
| * Popouts. | | | |
| Observation: | | | |
| a. Conical holes less than 5/8" in diameter. *** {Severity M} | SF | | |
| b. Conical holes greater than 5/8" in diameter. *** {Severity H} | SF | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

◆ 13.02.01 RETAINING WALLS - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Erosion, displacement of material from around retaining wall. | | | |
| Observation: | | | |
| a. Erosion below existing grade line, base of retaining wall not exposed. | SF | | |
| *** {Severity M} | | | |
| b. Erosion below existing grade line, base of retaining wall exposed. | SF | | |
| *** {Severity H} | | | |
| * Excessive vegetation. | | | |
| Observation: | | | |
| a. Vines, trees and shrubs climbing over or growing into walls. | SF | | |
| *** {Severity H} | | | |
| b. Missing or obstructed drain/weep holes through wall. | EA | | |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

♦ 13.02.02 RETAINING WALLS - METAL

A metal retaining wall is made up of interlocking members of sheet steel driven into the ground to form a vertical wall. A concrete cap, tieback rods and wales are used to prevent lateral movement and cover the raw edges of the metal sheets. Weep holes are normally provided for drainage. Walls out of level or out of plumb may be checked by eyesight, string line between main points or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | 3 |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 3" in 8'. | SF | | 3 |
| *** {Severity H} | | | |
| * Damaged walls. | | | |
| Observation: | | | |
| a. Loose or bent metal wall members. | SF | | |
| *** {Severity L} | | | |
| b. Open seams or large holes up to 2 SF in metal wall members. | SF | | |
| *** {Severity M} | | | |
| c. Open seam or large hole more than 2 SF or missing section. | SF | | |
| *** {Severity H} | | | |
| * Broken, damaged, loose, corroded or missing anchors or fasteners. | | | |
| Observation: | | | |
| a. Loose anchors or fasteners. | EA | | |
| *** {Severity L} | | | |
| b. Corroded anchors or fasteners. | EA | | |
| *** {Severity M} | | | |
| c. Broken, missing or damaged fasteners. | EA | | |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

◆ 13.02.02 RETAINING WALLS - METAL (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Corrosion. | | | |
| Observation: | | | |
| a. Surface corrosion (no pitting evident). | SF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | SF | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by holes or loss of base metal. | SF | | |
| *** {Severity H} | | | |
| * Erosion, displacement of material from around retaining wall. | | | |
| Observation: | | | |
| a. Erosion below existing grade line, base of retaining wall not exposed. | SF | | |
| *** {Severity M} | | | |
| b. Erosion below existing grade line, base of retaining wall exposed. | SF | | |
| *** {Severity H} | | | |
| * Excessive vegetation. | | | |
| Observation: | | | |
| a. Vines, trees and shrubs climbing over or growing into walls. | SF | | |
| *** {Severity H} | | | |
| b. Missing or obstructed drain/weep holes through wall. | EA | | |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

♦ 13.02.03 RETAINING WALLS - WOOD

Wood retaining walls may be constructed with flat sided or round timbers installed side by side in soil, as deep in the soil as the wall is above the soil. Timbers or railroad ties may be installed horizontally with a metal tieback rod. Treated wood should be used throughout all walls. Weep holes are normally provided for drainage. Walls out of level or out of plumb may be checked by eyesight, string line between main points or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Split, cracked, broken or missing. | | | |
| Observation: | | | |
| a. Surface fibers separated, less than 25 percent of thickness affected. | SF | | |
| *** {Severity M} | | | |
| b. Surface fibers separated, greater than 25 percent of thickness affected. | SF | | |
| *** {Severity H} | | | |
| c. Physically damaged, broken or missing. | SF | | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | 4 |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 3" in 8'. | SF | | 4 |
| *** {Severity H} | | | |
| * Defective anchors or fasteners. | | | |
| Observation: | | | |
| a. Loose anchors or fasteners. | EA | | |
| *** {Severity L} | | | |
| b. Broken, missing or damaged anchors or fasteners. | EA | | |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

♦ 13.02.03 RETAINING WALLS - WOOD (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Rot, fungus or decay. | | | |
| Observation: | | | |
| a. Moist stained area. | SF | | |
| *** {Severity M} | | | |
| b. Discolored, soft or crushed area. | SF | 1 | 5 |
| *** {Severity H} | | | |
| * Parasite damage. | | | |
| Observation: | | | |
| a. Holes less than 1/8" diameter, surface sag, and frass observed. | SF | 1 | 5 |
| *** {Severity M} | | | |
| b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing. | SF | 1 | 5 |
| *** {Severity H} | | | |
| * Erosion, displacement of material from around retaining wall. | | | |
| Observation: | | | |
| a. Erosion below existing grade line, base of retaining wall not exposed. | SF | | |
| *** {Severity M} | | | |
| b. Erosion below existing grade line, base of retaining wall exposed. | SF | | |
| *** {Severity H} | | | |
| * Excessive vegetation. | | | |
| Observation: | | | |
| a. Vines, trees and shrubs climbing over or growing into walls. | SF | | |
| *** {Severity H} | | | |
| b. Missing or obstructed drain/weep holes through wall. | EA | | |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

◆ 13.02.04 RETAINING WALLS - REINFORCED EARTH

Reinforced earth retaining walls consist of three elements which together make up the wall structure.

- a. The earth backfill, which extends from a new wall facing to the end of layers of metal reinforcing strips.
- b. The reinforcing strips, which are fabricated of galvanized steel or aluminum alloy and which are fastened only at one end to the facing. These extend through the soil to the back of the earth backfill.
- c. The facing, which is either galvanized steel elements of elliptical cross section or interlocking precast concrete panels.

Walls out of level or out of plumb may be checked with eyesight, string line between main points or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 5" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 5" in 8'. | SF | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 5" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 5" in 8'. | SF | | |
| *** {Severity H} | | | |
| * Broken, damaged, loose, or missing fasteners. | | | |
| Observation: | | | |
| a. Loose fasteners. | EA | | |
| *** {Severity L} | | | |
| b. Broken or missing fasteners. | EA | | |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

♦ 13.02.04 RETAINING WALLS - REINFORCED EARTH (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Corrosion. of metal facing, strips or fasteners. | | | |
| Observation: | | | |
| a. Surface corrosion (no pitting evident). | SF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | SF | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by loss of base metal. | SF | | |
| *** {Severity H} | | | |
| * Erosion, displacement of material from around retaining wall. | | | |
| Observation: | | | |
| a. Erosion below existing grade line, base of retaining wall not exposed. | SF | | |
| *** {Severity M} | | | |
| b. Erosion below existing grade line, base of retaining wall exposed. | SF | | |
| *** {Severity H} | | | |
| * Excessive vegetation. | | | |
| Observation: | | | |
| a. Vines, trees and shrubs climbing over or growing into walls. | SF | | |
| *** {Severity H} | | | |
| b. Missing or obstructed drain/weep holes through wall. | EA | | |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

♦ 13.02.04 RETAINING WALLS - REINFORCED EARTH (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking of concrete facing. | | | |
| Observation: | | | |
| a. Hairline cracks, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, between 1/16" and 1/4" wide. | LF | | 6 |
| *** {Severity H} | | | |
| d. Disintegration of surface or cracks exceeding depth of 2". | SF | | 6 |
| *** {Severity H} | | | |
| * Spalling of concrete facing. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area, with corrosion of exposed reinforcing steel. | SF | | 7 |
| *** {Severity H} | | | |
| * Scaling of concrete facing. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | SF | | |
| *** {Severity M} | | | |
| b. Loss of surface from 1/2" to 1" deep with coarse aggregates clearly exposed. | SF | | |
| *** {Severity H} | | | |
| c. Loss of surface exceeds 1", reinforcing steel usually exposed. | SF | | 7 |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

◆ 13.02.04 RETAINING WALLS - REINFORCED EARTH (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | SF | | 7 |
| *** {Severity H} | | | |
| * Popouts. | | | |
| Observation: | | | |
| a. Conical holes less than 5/8" in diameter. | SF | | |
| *** {Severity M} | | | |
| b. Conical holes greater than 5/8" in diameter. | SF | | |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

♦ 13.02.05 RETAINING WALLS - MASONRY/STONE

Masonry/stone retaining walls may be installed with or without concrete footing. Brick or CMU are installed vertically to the soil grade while stone, with or without mortar normally tilts into the soil grade. All walls should have a coping, brick row lock or flagstone walltop covering to prevent water/freeze damage. Weep holes through the wall with gravel and drain pipes on soil side of wall are normally used to reduce water pressure behind wall. Walls out of level or out of plumb may be checked by eyesight, string line between main corners or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracks in retaining wall. | | | |
| Observation: | | | |
| a. Hairline cracks, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, between 1/16" and 1/4" wide. | LF | | 8 |
| *** {Severity H} | | | |
| d. Extensive disintegration of surface or cracks exceeding depth of 2". | SF | | 8 |
| *** {Severity H} | | | |
| * Deteriorated mortar joint material. | | | |
| Observation: | | | |
| a. Cracked mortar joint material. | LF | | |
| *** {Severity L} | | | |
| b. Loose/missing mortar joint material. | LF | | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | 9 |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 3" in 8'. | SF | | 9 |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

COMPONENTS (Continued)

♦ 13.02.05 RETAINING WALLS - MASONRY/STONE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Erosion, displacement of material from around retaining wall. | | | |
| Observation: | | | |
| a. Erosion below existing grade line, base of retaining wall not exposed. | SF | | |
| *** {Severity M} | | | |
| b. Erosion below existing grade line, base of retaining wall exposed. | SF | | |
| *** {Severity H} | | | |
| * Excessive vegetation. | | | |
| Observation: | | | |
| a. Vines, trees and shrubs climbing over or growing into walls. | SF | | |
| *** {Severity H} | | | |
| b. Missing or obstructed drain/weep holes through wall. | EA | | |
| *** {Severity H} | | | |

13.02 RETAINING WALLS

REFERENCES

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994
2. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993
3. NAVFAC MO-102, Maintenance and Repair of Surface Areas, 1977

13.02 RETAINING WALLS

LEVEL II KEY GUIDE SHEET CONTROL NUMBER

| | |
|---|------------------|
| 1 | GS-II 13.02.03-1 |
|---|------------------|

LEVEL III KEY GUIDE SHEET CONTROL NUMBER

| | |
|---|-------------------|
| 1 | GS-III 13.02.01-1 |
| 2 | GS-III 13.02.01-2 |
| 3 | GS-III 13.02.02-3 |
| 4 | GS-III 13.02.03-4 |
| 5 | GS-III 13.02.03-5 |
| 6 | GS-III 13.02.04-6 |
| 7 | GS-III 13.02.04-7 |
| 8 | GS-III 13.02.05-8 |
| 9 | GS-III 13.02.05-9 |

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: RETAINING WALLS - WOOD
CONTROL NUMBER: GS-II 13.02.03-1

Application

This guide applies to the investigation of possible deterioration of the interior and exterior surfaces of retaining wall due to rot, fungi, decay or parasite damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area using scraper and brush.
2. Utilize calipers, depth gauge and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick or pocket knife to determine the extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO.1

COMPONENT: RETAINING WALLS - CONCRETE
CONTROL NUMBER: GS-III 13.02.01-1

Application

This guide applies to the investigation of cracks in concrete retaining walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.
4. If footings are exposed, examine for cracks or breaks and take core samples for analysis to determine condition or strength of the footing.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: RETAINING WALLS - CONCRETE
CONTROL NUMBER: GS-III 13.02.01-2

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete retaining walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994
2. NAVFAC MO-102, Maintenance and Repair of Surface Areas, 1977

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: RETAINING WALLS - METAL
CONTROL NUMBER: GS-III 13.02.02-3

Application

This guide applies to the investigation of out of level or out of plumb metal retaining walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for uneven settlement by observing condition of surrounding exterior grade.
2. Investigate past history of leak repair which can signify hydrostatic pressures creating bulging settlement.
3. Check all sealant, expansion/contraction joints or mortar joints for deterioration which will allow for water penetration.
4. Perform NDT, in this case ultrasonic pulse velocity test to compare structural integrity from one part of the retaining wall to another and identify locations of cracks, breaks and other subsurface disintegration that could contribute to out of level or out of plumb retaining walls.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: RETAINING WALLS - WOOD
CONTROL NUMBER: GS-III 13.02.03-4

Application

This guide applies to the investigation of out of level or out of plumb wood retaining walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Sound with hammer.
2. Bore or core (should be angled to prevent water accumulation). Plug hole with treated dowels. Examine core at the site and send to laboratory for biological studies.
3. Test with a moisture meter.
4. Check for uneven settlement by observing condition of surrounding exterior or foundation slab.
5. Investigate past history of leak repair which can signify uneven hydrostatic pressures creating bulging settlement.
6. Check all sealant, expansion/contraction joints or mortar joints for deterioration which will allow for water penetration.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

- | | |
|------------------------|--------------------|
| 1. One-pound hammer | 2. Increment borer |
| 3. Treated wood dowels | 4. Moisture meter |

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: RETAINING WALLS - WOOD
CONTROL NUMBER: GS-III 13.02.03-5

Application

This guide applies to the investigation of deterioration of wood retaining walls due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Sound with hammer.
2. Bore or core (should be angled to prevent water accumulation). Plug hole with treated dowels. Examine core at the site and send to laboratory for biological studies.
3. Test with a moisture meter.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

- | | |
|------------------------|--------------------|
| 1. One-pound hammer | 2. Increment borer |
| 3. Treated wood dowels | 4. Moisture meter |

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: RETAINING WALLS - REINFORCED EARTH
CONTROL NUMBER: GS-III 13.02.04-6

Application

This guide applies to the investigation of cracks in precast concrete facing panels.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.
4. If footings are exposed, examine for cracks or breaks and take core samples for analysis to determine condition or strength of the footing.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994
2. NAVFAC MO-102, Maintenance and Repair of Surface Areas, 1977

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: RETAINING WALLS - REINFORCED EARTH
CONTROL NUMBER: GS-III 13.02.04-7

Application

This guide applies to the investigation of corrosion of reinforcing steel in precast concrete facing panels.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994
2. NAVFAC MO-102, Maintenance and Repair of Surface Areas, 1977

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: RETAINING WALLS - MASONRY/STONE
CONTROL NUMBER: GS-III 13.02.05-8

Application

This guide applies to the investigation of cracks in brick, CMU or stone masonry retaining walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check cracks for any stress related condition, construction movement, settlement or overload.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT to determine extent of internal cracking and disintegration, in this case ultrasonic pulse velocity inspection.
4. If footings are exposed, examine for cracks or breaks and take core samples for lab analysis to determine condition or strength of the footing plug core holes with epoxy sealer after boring.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: RETAINING WALLS - MASONRY/STONE
CONTROL NUMBER: GS-III 13.02.05-9

Application

This guide applies to the investigation of out of level or out of plumb brick, CMU block or stone masonry fence walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for uneven settlement by observing condition of exterior grade or foundation slab.
2. Investigate past history of leak repair which can signify hydrostatic pressures creating bulging settlement.
3. Check all sealant, expansion/contraction joints or mortar joints for deterioration which can allow water penetration.
4. Perform NDT, in this case ultrasonic pulse velocity test to compare structural integrity from one part of the retaining wall to another and identify locations of cracks, breaks and other subsurface disintegration that could contribute to out of level or out of plumb walls.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

13.03 FOUNTAINS AND POOLS

DESCRIPTION

Fountains and Pools is a subsystem of the Grounds and Miscellaneous Structures System. A fountain is a device that has an artificially created jet or stream of water. A pool is normally a vessel of water that is used for recreational purposes.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of Fountains and Pools, beyond the requirements listed in the Standard Tools Section.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Fountains and Pools, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- ◆ 13.03.01 SURFACE - VINYL
- ◆ 13.03.02 SURFACE - CONCRETE
- ◆ 13.03.03 SURFACE - GUNITE
- ◆ 13.03.04 SURFACE - METAL
- ◆ 13.03.05 SURFACE - TILE
- ◆ 13.03.06 SURFACE - FIBERGLASS
- ◆ 13.03.07 COPING
- ◆ 13.03.08 HARDWARE AND POOL ACCESSORIES
- ◆ 13.03.09 POOL DECK - CONCRETE
- ◆ 13.03.10 POOL DECK - STONE
- ◆ 13.03.11 POOL DECK - TILE
- ◆ 13.03.12 CIRCULATING PUMPS
- ◆ 13.03.13 POOL WATER HEATERS
- ◆ 13.03.14 PIPING, FITTINGS AND VALVES
- ◆ 13.03.15 WATER FILTERS AND CHLORINATORS
- ◆ 13.03.16 UNDERWATER LIGHTS

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

- | | |
|-------|-------------------------------|
| 01.01 | FOUNDATION WALLS AND PIERS |
| 01.02 | SLAB-ON-GRADE, BASES AND PITS |
| 13.02 | RETAINING WALLS |

13.03 FOUNTAINS AND POOLS

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspection as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observation and should be accomplished by the inspector at that time.

For pumps in general use, Level I, II & III inspection methods will apply in accordance with the following gallon-per-minute ranges:

- a. Use Level I inspection method if GPM is less than 40.
- b. Use Level I, II and/or III inspection methods if GPM is 40 or greater.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

- a. Use Level I inspection method if HP is less than 15.
- b. Use Level I & II inspection methods if HP is 15 to 60.
- c. Use Level I, II and/or III inspection methods if HP is greater than 60.

The Facility Manager will specify the level of inspection required for specialized pump and motors applications.

Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

◆ 13.03.01 SURFACE - VINYL

Sheet vinyl is often installed as a waterproof pliable pool liner over rigid support (concrete, gunite, CMU, metal, wood, floor and walls), because it resists leaks, abrasions, mildew, mold, fungus and chemical damage. A recessed, rimflow or regular overflow gutter type system is normally constructed around the top of a pool wall to maintain water level, act as a water skimmer and provide a means of directing water toward a filter treating unit.

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.01 SURFACE - VINYL (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Surface defects, splits, holes or cuts. | | | |
| Observation: | | | |
| a. Membrane weathered, scuffed or abraded, no obvious water penetration. | SF | | |
| *** {Severity L} | | | |
| b. Membrane separating from substrate, no obvious water penetration. | LF | | |
| *** {Severity M} | | | |
| c. Rough membrane substrate with protrusions greater than 1/4". | SF | | |
| *** {Severity M} | | | |
| d. Cuts, punctures, tears or missing membrane, obvious water penetration. | SF | | |
| *** {Severity H} | | | |
| * Patched or repaired areas. | | | |
| Observation: | | | |
| a. Patching material inferior to or incompatible with existing pool membrane. | LF | | |
| *** {Severity M} | | | |
| * Blocked drains. | | | |
| Observation: | | | |
| a. Sediment and rust on main drains. | SF | | |
| *** {Severity M} | | | |
| b. Obstruction in gutter drains. | SF | | |
| *** {Severity M} | | | |
| * Stains and dirt. | | | |
| Observation: | | | |
| a. Stains on walls from water or corroded fittings. | SF | | |
| *** {Severity M} | | | |
| b. Rough and dirty wall and floor finishes. | SF | | |
| *** {Severity M} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.02 SURFACE - CONCRETE

A concrete fountain or pool may have precast or poured-in-place walls and floor. Around the pool wall perimeter a roll out, rimflow or recessed overflow gutter or trench unit may be provided. Concrete walls and floors are usually coated with a waterproof sealant.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline crack, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, between 1/16" and 1/4" wide. | LF | | |
| *** {Severity H} | | | |
| d. Disintegration of surface or cracks exceeding depth of 2" | SF | | 1 |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area and corrosion of exposed reinforcing steel. | SF | | 2 |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.02 SURFACE - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | SF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep with coarse aggregates clearly exposed. | SF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeding 1" deep and corrosion of exposed reinforcing steel. | SF | | 2 |
| *** {Severity H} | | | |
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | LF | | 2 |
| *** {Severity H} | | | |
| * Popouts. | | | |
| Observation: | | | |
| a. Conical small holes less than 5/8" in diameter. | SF | | |
| *** {Severity M} | | | |
| b. Conical holes greater than 5/8" in diameter. | SF | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.02 SURFACE - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Blistering, cracking or peeling of wall and floor protective covering. | | | |
| Observation: | | | |
| a. Cracking and checking areas or protective covering. | SF | | |
| *** {Severity M} | | | |
| b. Blistering and wrinkling areas of protective covering. | SF | | |
| *** {Severity M} | | | |
| c. Peeling and flaking areas of protective covering. | SF | | |
| *** {Severity H} | | | |
| * Blocked drains. | | | |
| Observation: | | | |
| a. Sediment and rust in main drains. | SF | | |
| *** {Severity M} | | | |
| b. Obstruction in gutter drains. | SF | | |
| *** {Severity M} | | | |
| * Stains and dirt. | | | |
| Observation: | | | |
| a. Stains on walls from water or corroded fittings. | SF | | |
| *** {Severity M} | | | |
| b. Rough and dirty wall and floor finishes. | SF | | |
| *** {Severity M} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.03 SURFACE - GUNITE

A fountain or pool may be constructed -in-place with solid masonry backing walls and flooring covered with a waterproofing cement coating called gunite. This material may also be pneumatically pumped or shot directly into an excavated hole in the ground in layers, with or without wire or rebar framing support forming its own supporting and finishing walls. A smoother wall finish may be obtained by applying a plaster finish. Gunite walls and floors are usually coated with a waterproof sealant/paint.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Missing, separated or cracked joint sealant. | | | |
| Observation: | | | |
| a. Deteriorated joint sealant/caulk in walls above normal water level. | LF | | |
| *** {Severity M} | | | |
| b. Deteriorated joint sealant/caulk in walls and floor below normal water level. | LF | | |
| *** {Severity H} | | | |
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline crack, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, between 1/16" and 1/4" wide. | LF | | |
| *** {Severity H} | | | |
| d. Extensive disintegration of surface or cracks exceeding depth of 2" | SF | | 3 |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.03 SURFACE - GUNITE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area and corrosion of exposed reinforcing steel. | SF | | 4 |
| *** {Severity H} | | | |
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | SF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep with coarse aggregates clearly exposed. | SF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeding 1" deep and corrosion of exposed reinforcing steel. | SF | | 4 |
| *** {Severity H} | | | |
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | LF | | 4 |
| *** {Severity H} | | | |
| * Popouts. | | | |
| Observation: | | | |
| a. Conical small holes less than 5/8" in diameter. | SF | | |
| *** {Severity M} | | | |
| b. Conical holes greater than 5/8" in diameter. | SF | | |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.03 SURFACE - GUNITE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | |
| *** {Severity H} | | | |
| * Blistering, cracking or peeling of wall and floor protective covering. | | | |
| Observation: | | | |
| a. Cracking and checking areas or protective covering. | SF | | |
| *** {Severity M} | | | |
| b. Blistering and wrinkling areas of protective covering. | SF | | |
| *** {Severity M} | | | |
| c. Peeling and flaking areas of protective covering. | SF | | |
| *** {Severity H} | | | |
| * Blocked drains. | | | |
| Observation: | | | |
| a. Sediment and rust on main drains. | SF | | |
| *** {Severity M} | | | |
| b. Obstruction in gutter drains. | SF | | |
| *** {Severity M} | | | |
| * Stains and dirt. | | | |
| Observation: | | | |
| a. Stains on walls from water or corroded fittings. | SF | | |
| *** {Severity M} | | | |
| b. Rough and dirty wall and floor finishes. | SF | | |
| *** {Severity M} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.04 SURFACE - METAL

A fountain or pool may be constructed with steel or aluminum walls and flooring. Metal pool walls and flooring normally have a special coating or enamel finish to protect against corrosion.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Defective weld joint. | | | |
| Observation: | | | |
| a. Cracked weld joint with no obvious water penetration. | LF | | |
| *** {Severity M} | | | |
| b. Cracked weld joint with obvious water penetration. | LF | | 5 |
| *** {Severity H} | | | |
| * Corrosion. | | | |
| Observation: | | | |
| a. Surface corrosion no pitting evident. | SF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | SF | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by holes or loss of base metal. | SF | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.04 SURFACE - METAL (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Blistering, cracking or peeling of wall and floor protective covering. | | | |
| Observation: | | | |
| a. Cracking and checking areas or protective covering. | SF | | |
| *** {Severity M} | | | |
| b. Blistering and wrinkling areas of protective covering. | SF | | |
| *** {Severity M} | | | |
| c. Peeling and flaking areas of protective covering. | SF | | |
| *** {Severity H} | | | |
| * Blocked drains. | | | |
| Observation: | | | |
| a. Sediment and rust on main drains. | SF | | |
| *** {Severity M} | | | |
| b. Obstruction in gutter drains. | SF | | |
| *** {Severity M} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.05 SURFACE - TILE

Ceramic tile is often used to cover concrete, gunite or CMU pool walls, floors, rim and over flow gutters for decorative appearance and longevity. Ceramic tile is often preferred because of its ease of cleaning and resistance to mildew, mold, fungus and chemical damage.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Loose/missing tile. | | | |
| Observation: | | | |
| a. Loose tile. | SF | | 6 |
| *** {Severity H} | | | |
| b. Missing or broken tile. | SF | | 6 |
| *** {Severity H} | | | |
| * Cracking tile mortar joints. | | | |
| Observation: | | | |
| a. Cracks smaller than 1/16". | LF | | |
| *** {Severity L} | | | |
| b. Cracks between 1/16" and 1/8" wide. | LF | | |
| *** {Severity M} | | | |
| c. Cracks larger than 1/8" wide. | LF | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | 7 |
| *** {Severity H} | | | |
| * Blocked drains. | | | |
| Observation: | | | |
| a. Sediment and rust on main drains. | SF | | |
| *** {Severity M} | | | |
| b. Obstruction in gutter drains. | SF | | |
| *** {Severity M} | | | |
| * Stains and dirt. | | | |
| Observation: | | | |
| a. Stains on walls from water or corroded fittings. | SF | | |
| *** {Severity M} | | | |
| b. Rough and dirty wall and floor finishes. | SF | | |
| *** {Severity M} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.06 SURFACE - FIBERGLASS

A Fountain or pool may be constructed with fiberglass walls and flooring. Fiberglass walls and flooring sections are normally bolted together with gaskets or sealant between joints. Fiberglass pools come in various colors and the material has a natural finish that resists leaks, abrasions, mildew, mold, fungus and chemical damage.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Defective joint. | | | |
| Observation: | | | |
| a. Cracks in joint with no obvious water penetration. | LF | | |
| *** {Severity M} | | | |
| b. Cracks in joint with obvious water penetration. | LF | | |
| *** {Severity H} | | | |
| * Surface defects, weathered, holes or splits. | | | |
| Observation: | | | |
| a. Fiberglass weathered scuffed or abraded, no obvious water penetration. | SF | | |
| *** {Severity L} | | | |
| b. Cuts, punctures or splits with obvious water penetration. | SF | | |
| *** {Severity H} | | | |
| * Patched or repaired areas. | | | |
| Observation: | | | |
| a. Patching material inferior to or incompatible with existing fiberglass surface. | SF | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.06 SURFACE - FIBERGLASS (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Blocked drains. | | | |
| Observation: | | | |
| a. Sediment and rust on main drains. | SF | | |
| *** {Severity M} | | | |
| b. Obstruction in gutter drains. | SF | | |
| *** {Severity M} | | | |
| * Stains and dirt. | | | |
| Observation: | | | |
| a. Stains on walls from water or corroded fittings. | SF | | |
| *** {Severity M} | | | |
| b. Rough and dirty wall and floor finishes. | SF | | |
| *** {Severity M} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

◆ 13.03.07 COPING

Precast concrete, limestone, marble, terra cotta or metal coping or cap stones are often installed on top surface of masonry fountain and pool walls and over rim flow water collection trenches to provide a decorative smooth edge, to divert rain or unfiltered water and trash from the pool.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Loose/missing. | | | |
| Observation: | | | |
| a. Loose masonry or metal coping. *** {Severity H} | LF | | 8 |
| b. Missing masonry or metal coping. *** {Severity H} | LF | | 8 |
| c. Missing metal joint covers on metal coping. *** {Severity H} | EA | | 8 |
| * Cracking, coping. | | | |
| Observation: | | | |
| a. Hairline crack, no loss of surface. *** {Severity L} | SF | | |
| b. Medium cracks, less than 1/16" wide. *** {Severity M} | LF | | |
| c. Wide cracks, between 1/16" and 1/4" wide. *** {Severity H} | LF | | 8 |
| d. Extensive disintegration of surface or cracks exceeding depth of 2" *** {Severity H} | SF | | 8 |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. *** {Severity M} | SF | | |
| b. More than 1/2" in 8'. *** {Severity H} | SF | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

◆ 13.03.07 COPING (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Spalling, masonry walls. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | 9 |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.08 HARDWARE AND POOL ACCESSORIES

Pool hardware may include wood or metal ladders, metal grab bars, metal cleats/hooks, flotation lines, depth markers, swim lane strips, and lifeguard stand.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Defective tower. | | | |
| Observation: | | | |
| a. Missing or worn nonslip covering. | SF | | |
| *** {Severity M} | | | |
| b. Platform towers out of alignment. | EA | | |
| *** {Severity M} | | | |
| c. Missing ladder rungs. | EA | | |
| *** {Severity H} | | | |
| * Corroded tower fittings or supports. | | | |
| Observation: | | | |
| a. Surface corrosion no pitting evident. | EA | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | EA | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by holes or loss of base metal. | EA | | |
| *** {Severity H} | | | |
| * Defective diving boards. | | | |
| Observation: | | | |
| a. Missing or worn nonslip covering. | SF | | |
| *** {Severity M} | | | |
| b. Surface fibers separated extending thorough entire member, less than 25 percent of thickness affected. | EA | | |
| *** {Severity M} | | | |
| c. Surface fibers separated extending through entire member, greater than 25 percent of thickness affected. | EA | | |
| *** {Severity H} | | | |
| d. Physically damaged and broken. | EA | | |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.08 **HARDWARE AND POOL ACCESSORIES (Continued)**

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Defective diving board connections/anchorage. | | | |
| Observation: | | | |
| a. Loose bolts or fasteners. | EA | | |
| *** {Severity M} | | | |
| bc. Missing or damaged bolts or fasteners. | EA | | |
| *** {Severity H} | | | |
| * Defective connections/anchorage. | | | |
| Observation: | | | |
| a. Loose bolts or fasteners. | EA | | |
| *** {Severity M} | | | |
| b. Missing or damaged bolts or fasteners. | EA | | |
| *** {Severity H} | | | |
| * Corroded hardware. | | | |
| Observation: | | | |
| a. Surface corrosion no pitting evident. | SF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | SF | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by holes or loss of base metal. | SF | | |
| *** {Severity H} | | | |
| * Illegible, soiled or missing. | | | |
| Observation: | | | |
| a. Soiled/illegible depth markings. | SF | | |
| *** {Severity L} | | | |
| b. Soiled/worn flotation lines. | | LF | |
| *** {Severity L} | | | |
| c. Missing/damaged depth markings. | SF | | |
| *** {Severity M} | | | |
| d. Missing/damaged flotation lines. | LF | | |
| *** {Severity M} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.09 POOL DECK - CONCRETE

A concrete deck around an outdoor pool is usually a poured slab-on-grade. The deck is required to slope away from the pool rim/coping to divert rain and other unfiltered water run off and trash away from the pool. For safety surfaces subject to a lot of traffic should have a nonslip covering.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline crack, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/8" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, greater than 1/8" wide. | LF | | 10 |
| *** {Severity H} | | | |
| d. Extensive disintegration of surface or cracks exceeding depth of 2" | SF | | 10 |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area and corrosion of exposed reinforcing steel. | SF | | 11 |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.09 POOL DECK - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | SF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep with coarse aggregates clearly exposed. | SF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeding 1" deep and corrosion of exposed reinforcing steel. | SF | | 11 |
| *** {Severity H} | | | |
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | LF | | 11 |
| *** {Severity H} | | | |
| * Popouts. | | | |
| Observation: | | | |
| a. Conical small holes less than 5/8" in diameter. | SF | | |
| *** {Severity M} | | | |
| b. Conical holes greater than 5/8" in diameter. | SF | | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | |
| *** {Severity H} | | | |
| * Nonslip covering. | | | |
| Observation: | | | |
| a. Nonslip covering worn or missing. | SF | | |
| *** {Severity M} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.10 POOL DECK - STONE

Decorative stone used on pool deck surfaces are normally installed over or as part of a concrete slab. For safety, surfaces subject to a lot of traffic should have a nonslip covering.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Loose/missing stone. | | | |
| Observation: | | | |
| a. Loose stone. | SF | | 12 |
| *** {Severity M} | | | |
| b. Missing or broken stone. | SF | | 12 |
| *** {Severity H} | | | |
| * Cracking stone mortar joints. | | | |
| Observation: | | | |
| a. Cracks less than 1/8" wide. | LF | | |
| *** {Severity M} | | | |
| c. Cracks larger than 1/8" wide. | LF | | |
| *** {Severity H} | | | |
| * Chipped/cracks stone. | | | |
| Observation: | | | |
| a. Chipped. | SF | | |
| *** {Severity L} | | | |
| b. Cracks smaller than 1/8". | SF | | |
| *** {Severity M} | | | |
| c. Cracks larger than 1/8". | SF | | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | 13 |
| *** {Severity H} | | | |
| * Nonslip covering. | | | |
| Observation: | | | |
| a. Nonslip covering worn or missing. | SF | | |
| *** {Severity M} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.11 POOL DECK - TILE

Decorative quarry or ceramic tile used on outdoor pool decks are normally installed over or as part of a concrete slab to prevent water penetration build up against exterior side of pool walls. When used on indoor pools the tile is installed over masonry flooring around perimeter of pool. Exterior decking also provides a stabilized area for lounging, pool ingress and egress and other functions associated with the pool. For safety, surfaces subject to a lot of traffic should have a nonslip covering.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Loose/missing tile. | | | |
| Observation: | | | |
| a. Loose tile. | SF | | 14 |
| *** {Severity M} | | | |
| b. Missing or broken tile. | SF | | 14 |
| *** {Severity H} | | | |
| * Cracking tile mortar joints. | | | |
| Observation: | | | |
| a. Cracks smaller than 1/16". | LF | | |
| *** {Severity L} | | | |
| b. Cracks between 1/16" and 1/8" wide. | LF | | |
| *** {Severity M} | | | |
| c. Cracks larger than 1/8" wide. | LF | | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8'. | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8. | SF | | 15 |
| *** {Severity H} | | | |
| * Nonslip covering. | | | |
| Observation: | | | |
| a. Nonslip covering worn or missing. | SF | | |
| *** {Severity M} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.12 CIRCULATING PUMPS

The pump circulates the pool water through the filter system and the fountain nozzles.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Excessive noise and vibration. | | | |
| Observation: | | | |
| a. Rattling noise at pump. *** {Severity M} | EA | 1 | 16 |
| b. Grinding noise at pump, indicating metal to metal contact. *** {Severity H} | EA | 1 | 16 |
| c. Electrical arcing noise (motor). *** {Severity H} | EA | | 17 |
| * Leakage. | | | |
| Observation: | | | |
| a. Leaking pump, fittings or seals. *** {Severity M} | EA | | |
| b. Cracked or damaged pump housing. *** {Severity M} | EA | | |
| * Damaged motor/pump. | | | |
| Observation: | | | |
| a. Cracked/damaged housing or end bells. *** {Severity H} | EA | | |
| b. Broken base. *** {Severity H} | EA | | |
| * Defective mounting hardware. | | | |
| Observation: | | | |
| a. Loose mounting bolts. *** {Severity L} | EA | | |
| b. Broken or missing mounting bolts. *** {Severity H} | EA | | |
| * Defective electrical connectors. | | | |
| Observation: | | | |
| a. Loose conduit or connectors. *** {Severity F} | EA | | |
| b. Exposed wires or missing cover plates. *** {Severity F} | EA | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.13 POOL WATER HEATERS

A pool water heater is a device that produces hot water, normally using electricity, gas or oil as an energy source.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Damaged enclosure. | | | |
| Observation: | | | |
| a. Loose enclosure panel. | SF | | |
| *** {Severity L} | | | |
| b. Missing or damaged enclosure panels. | SF | | |
| *** {Severity H} | | | |
| * Water leakage. | | | |
| Observation: | | | |
| a. Water dripping from fitting. | EA | | |
| *** {Severity L} | | | |
| b. Water dripping from inside enclosure. | EA | | |
| *** {Severity M} | | | |
| * Defective flue duct. | | | |
| Observation: | | | |
| a. Flue duct damaged/loose. | LF | | |
| *** {Severity M} | | | |
| b. Flue duct missing. | LF | | |
| *** {Severity H} | | | |
| * Damaged valve. | | | |
| Observation: | | | |
| a. Missing or broken valve handle. | EA | | |
| *** {Severity L} | | | |
| b. Bent stems. | EA | | |
| *** {Severity M} | | | |
| c. Leaking valve packing glands/gaskets. | EA | | |
| *** {Severity H} | | | |
| d. Cracked or damaged valve body. | EA | | |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.13 POOL WATER HEATERS (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Deteriorated water heater insulation. | | | |
| Observation: | | | |
| a. Loose insulation. | SF | | |
| *** {Severity L} | | | |
| b. Damaged or deteriorated insulation. | SF | | |
| *** {Severity M} | | | |
| c. Missing insulation. | SF | | |
| *** {Severity H} | | | |
| * Corroded enclosure. | | | |
| Observation: | | | |
| a. Surface corrosion no pitting evident. | SF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | SF | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by holes or loss of base metal. | SF | | |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.14 PIPING, FITTINGS AND VALVES

Piping and fittings provide the distribution network for the fountain or pool system. Valves are installed to control or isolate the system parts.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Leaking valves. | | | |
| Observation: | | | |
| a. Leaking check valve. | EA | | |
| *** {Severity L} | | | |
| b. Leaking valve packing glands/gaskets. | EA | | |
| *** {Severity M} | | | |
| * Damaged valves. | | | |
| Observation: | | | |
| a. Broken or missing valve handle. | EA | | |
| *** {Severity L} | | | |
| b. Bent stem. | EA | | |
| *** {Severity M} | | | |
| c. Cracked valve body. | EA | | |
| *** {Severity H} | | | |
| * Defective fitting. | | | |
| Observation: | | | |
| a. Bent or cracked fitting, not leaking. | EA | | |
| *** {Severity L} | | | |
| b. Water dripping. | EA | | |
| *** {Severity M} | | | |
| * Defective pipe. | | | |
| Observation: | | | |
| a. Bent or cracked pipe, not leaking. | LF | | |
| *** {Severity L} | | | |
| b. Water dripping. | LF | | |
| *** {Severity M} | | | |
| * Defective supports/hangers. | | | |
| Observation: | | | |
| a. Loose supports or hangers. | EA | | |
| *** {Severity L} | | | |
| b. Broken or missing supports or hangers. | EA | | |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.14 PIPING, FITTINGS AND VALVES (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Corrosion of supports or hangers. | | | |
| Observation: | | | |
| a. Surface corrosion no pitting evident. | EA | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | EA | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by holes or loss of base metal. | EA | | |
| *** {Severity H} | | | |
| * Defective pipe labeling/color coding. | | | |
| Observation: | | | |
| a. Damaged or missing labels. | EA | | |
| *** {Severity F} | | | |
| b. Damaged or missing color coding. | LF | | |
| *** {Severity F} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.15 WATER FILTERS AND CHLORINATORS

A water filter is installed in the pool or fountain water to remove foreign particles. Chlorinators maintain water purity and control organic matter growth.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Defective mounting hardware or supports. | | | |
| Observation: | | | |
| a. Loose hardware or supports. | EA | | |
| *** {Severity L} | | | |
| b. Missing or damaged hardware or supports. | EA | | |
| *** {Severity H} | | | |
| * Defective filter. | | | |
| Observation: | | | |
| a. Damaged enclosure. | EA | | |
| *** {Severity H} | | | |
| * Defective chlorinator. | | | |
| Observation: | | | |
| a. Damaged enclosure. | EA | | |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

COMPONENTS (Continued)

♦ 13.03.16 UNDERWATER LIGHTS

Fountains and pools accent lighting is provided by waterproof fixtures, usually recess mounted, in the bottom or sides of the fountain basin or pool walls.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Defective lens. | | | |
| Observation: | | | |
| a. Missing, broken or cracked lens. | EA | | |
| *** {Severity H} | | | |
| * Defective light. | | | |
| Observation: | | | |
| a. Loose light. | EA | | |
| *** {Severity M} | | | |
| a. Missing or broken light. | EA | | |
| *** {Severity L} | | | |
| * Damaged or loose wiring. | | | |
| Observation: | | | |
| a. Loose or broken conduit. | LF | | |
| *** {Severity M} | | | |
| b. Open or loose connection. | EA | | |
| *** {Severity H} | | | |
| c. Exposed wire or missing cover plate. | EA | | |
| *** {Severity H} | | | |
| * Corroded light. | | | |
| Observation: | | | |
| a. Surface corrosion no pitting evident. | EA | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | EA | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by holes or loss of base metal. | EA | | |
| *** {Severity H} | | | |

13.03 FOUNTAINS AND POOLS

REFERENCES

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994
2. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. American Water Works Association, Manual of Water Supply Practices, M-36, 1990
5. Uniform Plumbing Code, International Association of Plumbing and Mechanical Officials

13.03 FOUNTAINS AND POOLS

LEVEL II KEY GUIDE SHEET CONTROL NUMBER

| | |
|---|-------------------|
| 1 | GS-II 13.03.12.-1 |
|---|-------------------|

LEVEL III KEY GUIDE SHEET CONTROL NUMBER

| | |
|----|--------------------|
| 1 | GS-III 13.03.02-1 |
| 2 | GS-III 13.03.02-2 |
| 3 | GS-III 13.03.03-3 |
| 4 | GS-III 13.03.03-4 |
| 5 | GS-III 13.03.04-5 |
| 6 | GS-III 13.03.05-6 |
| 7 | GS-III 13.03.05-7 |
| 8 | GS-III 13.03.07-8 |
| 9 | GS-III 13.03.07-9 |
| 10 | GS-III 13.03.09-10 |
| 11 | GS-III 13.03.09-11 |
| 12 | GS-III 13.03.10-12 |
| 13 | GS-III 13.03.10-13 |
| 14 | GS-III 13.03.11-14 |
| 15 | GS-III 13.03.11-15 |
| 16 | GS-III 13.03.12-16 |
| 17 | GS-III 13.03.12-17 |

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: CIRCULATING PUMPS
CONTROL NUMBER: GS-II 13.03.12-1

Application

This guide applies to the investigation of rattling and grinding (metal to metal) noise from the pump.

For pumps in general use, Level I, II & III inspection methods will apply in accordance with the following gallon-per-minute ranges:

- a. Use Level I inspection method if GPM is less than 40.
- b. Use Level I, II and/or III inspection methods if GPM is 40 or greater.

The Facility Manager will specify the level of inspection required for specialized pump applications.

Special Safety Requirements

The following is a list of special safety requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.

Inspection Actions

1. Observe pump operation and determine possible source of noise.
2. Shut down pump, tag and lock out disconnect.
3. Check coupling for wear, damage or loose fasteners.
4. Examine drives for alignment.
5. Turn pump by hand and determine what is causing the noise.
6. Document the problem and contact appropriate facility personnel for further instructions, if defect cannot be determined or is major.
7. Notify appropriate facility personnel for permission to place unit back in service if defect is not critical to continued function.
8. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standard, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: SURFACE - CONCRETE
CONTROL NUMBER: GS-III 13.03.02-1

Application

This guide applies to the investigation of cracks in fountains and pools surface concrete.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: SURFACE - CONCRETE
CONTROL NUMBER: GS-III 13.03.02-2

Application

This guide applies to the investigation of corrosion of reinforcing steel in fountains and pools surface concrete.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: SURFACE - GUNITE
CONTROL NUMBER: GS-III 13.03.03-3

Application

This guide applies to the investigation of cracks in fountains and pools surface gunite.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: SURFACE - GUNITE
CONTROL NUMBER: GS-III 13.03.03-4

Application

This guide applies to the investigation of corrosion of reinforcing steel in fountains and pools gunite surface.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: SURFACE - METAL
CONTROL NUMBER: GS-III 13.03.04-5

Application

This guide applies to the investigation of cracks and cracked welds in the fountains and pools surface metal.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: SURFACE - TILE
CONTROL NUMBER: GS-III 13.03.05-6

Application

This guide applies to the investigation of loose, broken or cracked tile surfaces for fountains and pools.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check breaks or cracks for any stress related conditions, construction movement, settlement or overloads.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT to determine extent of internal cracking and disintegration, in this case ultrasonic pulse velocity inspection.
4. If support surfaces are exposed, examine for cracks or breaks and take core samples for lab analysis to determine condition or strength of the support surface. Plug core holes with epoxy sealer after boring.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: SURFACE - TILE
CONTROL NUMBER: GS-III 13.03.05-7

Application

This guide applies to the investigation of out of plumb tile surface.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for uneven settlement by observing condition of surrounding tile surface areas.
2. Investigate past history of leak repair which can signify uneven hydrostatic pressures creating bulging settlement.
3. Check all sealant, expansion/contraction joints or mortar joints for deterioration which can allow water penetration.
4. Perform NDT, in this case ultrasonic pulse velocity test to compare structural integrity from one part of the surface to another and identify locations of cracks, breaks and other subsurface disintegration that could contribute to the out of plumb tile surface.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: COPING
CONTROL NUMBER: GS-III 13.03.07-8

Application

This guide applies to the investigation of loose, missing or cracked fountains and pools coping.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check cracked joints, cuts, punctures for any stress related conditions, construction movement, settlement or overloads.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT to determine extent of internal cracking and disintegration, in this case ultrasonic pulse velocity inspection.
4. If walls are exposed, examine for cracks or breaks and take core samples for lab analysis to determine condition or strength of the wall. Plug core holes with epoxy sealer after boring.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: COPING
CONTROL NUMBER: GS-III 13.03.07-9

Application

This guide applies to the investigation of spalling in masonry walls supporting fountains and pools coping.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause spalling or surface deterioration.
2. Examine spalling to determine if active or dormant. Document the location, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the spalling to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: POOL DECK - CONCRETE
CONTROL NUMBER: GS-III 13.03.09-10

Application

This guide applies to the investigation of cracks in concrete pool decks for fountains and pools.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: POOL DECK - CONCRETE
CONTROL NUMBER: GS-III 13.03.09-11

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete pool decks for fountains and pools.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: POOL DECK - STONE
CONTROL NUMBER: GS-III 13.03.10-12

Application

This guide applies to the investigation of loose, broken or cracked stone pool decks for fountains and pools.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check breaks or cracks for any stress related conditions, construction movement, settlement or overloads.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT to determine extent of internal cracking and disintegration, in this case ultrasonic pulse velocity inspection.
4. If support surfaces are exposed, examine for cracks or breaks and take core samples for lab analysis to determine condition or strength of the support surface. Plug core holes with epoxy sealer after boring.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: POOL DECK - STONE
CONTROL NUMBER: GS-III 13.03.10-13

Application

This guide applies to the investigation of deviation from level of stone pool deck surface.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for uneven settlement by observing condition of surrounding stone surface areas.
2. Investigate past history of leak repair which can signify uneven hydrostatic pressures creating bulging settlement.
3. Check all sealant, expansion/contraction joints or mortar joints for deterioration which can allow water penetration.
4. Perform NDT, in this case ultrasonic pulse velocity test to compare structural integrity from one part of the surface to another and identify locations of cracks, breaks and other subsurface disintegration that could contribute to the deviation from level of stone surface.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: POOL DECK - TILE
CONTROL NUMBER: GS-III 13.03.11-14

Application

This guide applies to the investigation of loose, broken or cracked tile pool deck surfaces for fountains and pools.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check breaks or cracks for any stress related conditions, construction movement, settlement or overloads.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT to determine extent of internal cracking and disintegration, in this case ultrasonic pulse velocity inspection.
4. If support surfaces are exposed, examine for cracks or breaks and take core samples for lab analysis to determine condition or strength of the support surface. Plug core holes with epoxy sealer after boring.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15

COMPONENT: POOL DECK - TILE
CONTROL NUMBER: GS-III 13.03.11-15

Application

This guide applies to the investigation of deviation from level of tile pool deck surface for fountains and pools.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for uneven settlement by observing condition of surrounding tile surface areas.
2. Investigate past history of leak repair which can signify uneven hydrostatic pressures creating bulging settlement.
3. Check all sealant, expansion/contraction joints or mortar joints for deterioration which can allow water penetration.
4. Perform NDT, in this case ultrasonic pulse velocity test to compare structural integrity from one part of the surface to another and identify locations of cracks, breaks and other subsurface disintegration that could contribute to the deviation from level of tile surface.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16

COMPONENT: CIRCULATING PUMPS
CONTROL NUMBER: GS-III 13.03.12-16

Application

This guide applies to the investigation of rattling and grinding (metal to metal) noise from the pump.

For pumps in general use, Level I, II & III inspection methods will apply in accordance with the following gallon-per-minute ranges:

- a. Use Level I inspection method if GPM is less than 40.
- b. Use Level I, II and/or III inspection methods if GPM 40 or greater.

The Facility Manager will specify the level of inspection required for specialized pump applications.

Special Safety Requirements

The following is a list of special safety requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.

Inspection Actions

1. Observe pump operation and determine possible source of noise.
2. Perform vibration analysis on pump bearings.
3. Shut down pump, tag and lock out disconnect.
4. Isolate unit mechanically.
5. Rotate (cycle) pump to check for binding.
6. Measure run-out play in bearings due to wear; compare with manufacturer's specifications.
7. Check coupling for wear, damage, loose fasteners.
8. Check coupling for misalignment.
9. Open and inspect pump interior housing for cracks, fatigue, erosion, and corrosion, check suspicious areas.
10. Check interior shafting for signs of damage, fatigue or wear.
11. Check impellers (pistons) for erosion/corrosion, physical damage, distortion.
12. Rotate (cycle) shafting and check for distortion in shaft.
13. Check clearances between impeller and wear rings; compare with manufacturer's specifications.
14. Document the problem and contact appropriate facility personnel for further instructions and reassemble pump, if directed.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16 (Continued)

COMPONENT: CIRCULATING PUMPS
CONTROL NUMBER: GS-III 13.03.12-16

Inspection Actions (Continued)

15. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
16. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Special Tools and Equipment

The following is a list of special tools and equipment, beyond those listed in the Standard Tool Section, required to perform the inspection of the pump.

1. Alignment Tools
2. Vibration Tester
3. Dye Penetrant

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. Sydnor Hydrodynamics Inc., Portsmouth, VA

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17

COMPONENT: MOTORS
CONTROL NUMBER: GS-III 13.03.12-17

Application

This guide applies to the investigation of electrical arcing noise from the motor.

For electric motors in general use, Level I, II & III inspection methods will apply in accordance with the following horsepower ranges:

1. Use Level I inspection method if HP is less than 15.
2. Use Level I & II inspection methods if HP is 15 to 60.
3. Use Level I, II and/or III inspection methods if HP is greater than 60.

The Facility Manager will specify the level of inspection required for specialized motor applications.

Special Safety Requirements

The following is a list of special requirements beyond those listed in the Master Safety Plan and System Safety Section.

1. Notify affected personnel and obtain permission to take unit out of service.

Inspection Actions

1. Observe motor operation and determine possible source of noise.
2. Check voltage at motor and current draw. Compare to motor ratings and the requirements of the associated equipment.
3. Perform vibration analysis on the motor.
4. Rotate motor shaft and check for binding, rubbing.
5. Measure run-out play in bearings due to wear; compare with manufacturer's specification.
6. Check alignment.
7. Shut down motor and lock out disconnect.
8. Open motor and inspect interior housing for stress cracks, corrosion, other physical damage, check suspicious areas with dye penetrant.
9. Check stator windings for dirt, moisture, physical damage, signs of overheating, loose fasteners.
10. Check rotor windings for dirt, moisture, physical damage, signs of overheating, loose fasteners.
11. Check commutator/slip rings for loose parts, physical damage, wear.
12. Check brushes for wear, proper tension.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17 (Continued)

COMPONENT: MOTORS
CONTROL NUMBER: GS-III 13.03.12-17

Inspection Actions (Continued)

13. Check bearings for lube leakage into motor.
14. Check motor shafting for wear.
15. Document the problem and contact appropriate facility personnel for further instructions and reassemble motor, if directed.
16. Notify appropriate personnel for permission to place unit back in service if defect is not critical to continued function.
17. Ensure all guards and covers have been installed; remove tags, lockout on disconnect and restore unit to service.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Alignment Tools
2. Vibration Tester
3. Infrared Temperature Tester
4. Ammeter
5. Voltmeter
6. Dye Penetrant

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. Electric Motor & Contracting Co. Inc., Chesapeake, VA

13.04 DOMES (BULK STORAGE)

DESCRIPTION

Domes is a subsystem of the Grounds and Miscellaneous Structures System. Domes are structural shells curved in two directions and are considered as one of the most efficient structural systems because the radial shape helps resist loads. Bulk storage domes are normally prefabricated or pre-engineered with wood, plywood, aluminum or fiberglass. In some cases they may also be constructed in place with thin walled reinforced concrete.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of Domes, beyond the requirements listed in the Standard Tools Section.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Domes, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- ◆ 13.04.01 FLOORS/FOUNDATIONS - CONCRETE
- ◆ 13.04.02 FLOORS/FOUNDATIONS - BITUMINOUS COATED
- ◆ 13.04.03 RETAINING WALL
- ◆ 13.04.04 FRAMING - METAL
- ◆ 13.04.05 FRAMING - WOOD
- ◆ 13.04.06 FRAMING - CONCRETE
- ◆ 13.04.07 EXTERIOR COVERING - CONCRETE
- ◆ 13.04.08 EXTERIOR COVERING - METAL
- ◆ 13.04.09 EXTERIOR COVERING - PLASTIC
- ◆ 13.04.10 EXTERIOR COVERING - WOOD

RELATED SYSTEMS

Due to the related nature of the elements requiring inspection, the following sub-systems should be reviewed for concurrent inspection activities.

- 01.02 SLAB-ON-GRADE, BASES AND PITS
- 02.01 STRUCTURAL FRAMES
- 02.02 FLOOR FRAMING AND DECKS
- 04.03 PANEL ROOFING
- 04.05 SHINGLE ROOFING

13.04 DOMES (BULK STORAGE)

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

♦ 13.04.01 FLOORS/FOUNDATIONS - CONCRETE

The foundation of bulk storage domes are normally concrete slab-on-grade.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline cracks, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, between 1/16" and 1/4" wide. | LF | | 1 |
| *** {Severity H} | | | |
| d. Extensive disintegration of surface or cracks exceeding depth of 2". | SF | | 1 |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area, with corrosion of exposed reinforcing steel. | SF | | 2 |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.01 FLOORS/FOUNDATIONS - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | SF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed. | SF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeding 1" deep. | SF | | |
| *** {Severity H} | | | |
| d. Exposure of reinforcing steel. | SF | | 2 |
| *** {Severity H} | | | |
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | SF | | 2 |
| *** {Severity H} | | | |
| * Popouts. | | | |
| Observation: | | | |
| a. Conical holes less than 5/8" in diameter. | SF | | |
| *** {Severity M} | | | |
| b. Conical holes greater than 5/8" in diameter. | SF | | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8". | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | 3 |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.02 FLOORS/FOUNDATIONS - BITUMINOUS COATED

The foundation of bulk storage domes may be concrete slab-on-grade with a bituminous surface coating.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline cracks, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, between 1/16" and 1/4" wide. | LF | | 4 |
| *** {Severity H} | | | |
| d. Extensive disintegration of surface or cracks exceeding depth of 2". | SF | | 4 |
| *** {Severity H} | | | |
| * Grease, solvent or oil on bituminous. | | | |
| Observation: | | | |
| a. Grease, solvent or oil drippings, no sign of deterioration. | SF | | |
| *** {Severity M} | | | |
| b. Grease, solvent or oil drippings, causing signs of deterioration. | SF | | |
| *** {Severity H} | | | |
| * Substrate failure, bituminous. | | | |
| Observation: | | | |
| a. Depressed or soft areas on/under bituminous. | SF | | 5 |
| *** {Severity H} | | | |
| * Defective patched or repaired areas. | | | |
| Observation: | | | |
| a. Patched material inferior to or incompatibly with existing bituminous. | SF | | |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.02 FLOORS/FOUNDATIONS - BITUMINOUS COATED (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--------------------------------------|-----|-----------------|------------------|
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8". | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | 5 |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

◆ 13.04.03 RETAINING WALL

The retaining wall is typically a reinforced concrete tension ring designed to withstand the pressure of the stored material and the dome structure's dead and live loads. The retaining wall sits on the floating mat foundation.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline crack, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/8" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, greater than 1/8" wide | LF | | 6 |
| *** {Severity H} | | | |
| d. Extensive disintegration of surface or cracks exceeding depth of 2". | SF | | 6 |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area and corrosion of exposed reinforcing steel. | SF | | 7 |
| *** {Severity H} | | | |
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | SF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep with coarse aggregates clearly exposed. | SF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeding 1" deep and corrosion of exposed reinforcing steel. | SF | | 7 |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

◆ 13.04.03 RETAINING WALL (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | LF | | 7 |
| *** {Severity H} | | | |
| * Popouts. | | | |
| Observation: | | | |
| a. Conical small holes less than 5/8" in diameter. | SF | | |
| *** {Severity M} | | | |
| b. Conical holes greater than 5/8" in diameter. | SF | | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 1/2" in 8". | SF | | |
| *** {Severity M} | | | |
| b. More than 1/2" in 8'. | SF | | 8 |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.04 FRAMING - METAL

Metal framing for bulk storage domes usually includes girders, trusses and bracing assembled into radial and parallel ribs to form triangulated or radial arched metal frame domes. The radial nature of this raised curved framing requires visual inspection aided with binoculars.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Cracking or buckling. | | | |
| Observation: | | | |
| a. Deformation, twist, and bending. | LF | | |
| *** {Severity H} | | | |
| b. Physically damaged member. | LF | | |
| *** {Severity H} | | | |
| c. Stress or fatigue cracks. | LF | | 9 |
| *** {Severity H} | | | |
| * Corrosion. | | | |
| Observation: | | | |
| a. Surface corrosion no pitting evident. | LF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | LF | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by holes or loss of base metal. | LF | | |
| *** {Severity H} | | | |
| * Defective connections/anchorages. | | | |
| Observation: | | | |
| a. Loose bolts, rivets or mechanical fasteners. | EA | | |
| *** {Severity M} | | | |
| b. Cracked or broken welds. | EA | | 9 |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.05 FRAMING - WOOD

Wood framing for small bulk storage domes is constructed with framing grade wood studs, beams, girts, joists, trusses and etc. while larger ones use laminated wood.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Split, cracked, broken or missing. | | | |
| Observation: | | | |
| a. Surface fibers separated, less than 25 percent of thickness affected. | SF | | |
| *** {Severity M} | | | |
| b. Surface fibers separated, greater than 25 percent of thickness affected. | SF | | |
| *** {Severity H} | | | |
| c. Missing, damaged, broken or deflected. | SF | | |
| *** {Severity H} | | | |
| * Rot, fungus or decay. | | | |
| Observation: | | | |
| a. Moist stained area. | SF | | |
| *** {Severity M} | | | |
| b. Discolored, soft or crushed area. | SF | 1 | 10 |
| *** {Severity H} | | | |
| * Parasite damage. | | | |
| Observation: | | | |
| a. Holes less than 1/8" diameter, surface sag, and frass observed. | SF | 1 | 10 |
| *** {Severity M} | | | |
| b. Holes greater than 1/8" diameter, surface channels, punctures, and crushing. | SF | 1 | 10 |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.05 FRAMING - WOOD (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Defective connections/anchorages. | | | |
| Observation: | | | |
| a. Loose wood at connection site. | EA | | |
| *** {Severity M} | | | |
| b. Broken, split, or damaged wood at connection site. | EA | | |
| *** {Severity H} | | | |
| c. Missing fasteners or anchorage. | EA | | |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.06 FRAMING - CONCRETE

Concrete structural framing includes cast-in-place and pre-cast columns, beams, trusses and miscellaneous frame elements. It is used where function and scale require strength and durability. Distress of concrete structures is visually displayed as cracking, spalling, scaling and other signs of disintegration.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline cracks, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, between 1/16" and 1/4" wide. | LF | | 11 |
| *** {Severity H} | | | |
| d. Extensive disintegration of surface or cracks exceeding depth of 2". | SF | | 11 |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area, with corrosion of exposed reinforcing steel. | SF | | 12 |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

◆ 13.04.06 FRAMING - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | SF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed. | SF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeding 1" deep. | SF | | |
| *** {Severity H} | | | |
| d. Exposure of reinforcing steel. | SF | | 12 |
| *** {Severity H} | | | |
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | SF | | 12 |
| *** {Severity H} | | | |
| * Popouts. | | | |
| Observation: | | | |
| a. Conical holes less than 5/8" in diameter. | SF | | |
| *** {Severity M} | | | |
| b. Conical holes greater than 5/8" in diameter. | SF | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.07 EXTERIOR COVERING - CONCRETE

Concrete covering over domes is relatively thin. It is common to place reinforcement welded-wire or individual bars in both the circumferential direction and perpendicular direction.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline cracks, no loss of surface. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks, less than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| c. Wide cracks, between 1/16" and 1/4" wide. | LF | | 13 |
| *** {Severity H} | | | |
| d. Extensive disintegration of surface or cracks exceeding depth of 2". | SF | | 13 |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area, with corrosion of exposed reinforcing steel. | SF | | 14 |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.07 EXTERIOR COVERING - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | SF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep, with coarse aggregates clearly exposed. | SF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeding 1" deep. | SF | | |
| *** {Severity H} | | | |
| d. Exposure of reinforcing steel. | SF | | 14 |
| *** {Severity H} | | | |
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | SF | | 14 |
| *** {Severity H} | | | |
| * Popouts. | | | |
| Observation: | | | |
| a. Conical holes less than 5/8" in diameter. | SF | | |
| *** {Severity M} | | | |
| b. Conical holes greater than 5/8" in diameter. | SF | | |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.08 EXTERIOR COVERING - METAL

Exterior metal wall covering for bulk storage domes may be either preformed or formed on the job site from a variety of galvanized or protective coated metals of various lengths, widths and shapes. Metal wall covering is secured together to wood or metal framing with interlocking joints, clips, bolts, rivets, nails, solder and other ties.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Panel damage or deterioration. | | | |
| Observation: | | | |
| a. Deteriorated or missing protective coating, some corrosion evident. | SF | | |
| *** {Severity M} | | | |
| b. Bent or warped panels, no obvious water penetration or ponding. | SF | | |
| *** {Severity M} | | | |
| c. Bent or warped panels, obvious water penetration or ponding. | SF | | |
| *** {Severity H} | | | |
| d. Cracks, holes or punctures in panel, obvious water penetration. | SF | | |
| *** {Severity H} | | | |
| * Lap and seam defects. | | | |
| Observation: | | | |
| a. Damaged or bent seams, no obvious water penetration. | LF | | |
| *** {Severity L} | | | |
| b. Missing or separated panel end lap sealant. | LF | | |
| *** {Severity M} | | | |
| c. Damaged or open seam/lap, obvious water penetration. | LF | | |
| *** {Severity H} | | | |
| d. Missing or loose end/top closure strips. | LF | | |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.08 EXTERIOR COVERING - METAL (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---------|-----|-----------------|------------------|
|---------|-----|-----------------|------------------|

*** Fastener defects.****Observation:**

a. Scattered, loose or missing fasteners, EA
potential for panel damage.

*** {Severity M}

b. Loose or missing panel fasteners, panel EA
damage imminent.

*** {Severity H}

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.09 EXTERIOR COVERING - PLASTIC

Exterior plastic covering typically consists of preformed panels in varying lengths, widths and shapes. The panels are usually translucent plastic.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Panel damage or deterioration. | | | |
| Observation: | | | |
| a. Crazed, deteriorated or missing surface coating, exposing fabric. | SF | | |
| *** {Severity M} | | | |
| b. Cracked, broken or punctured panels, obvious water penetration. | SF | | |
| *** {Severity H} | | | |
| * Lap and joint defects. | | | |
| Observation: | | | |
| a. Missing or separated panel end lap sealant. | LF | | |
| *** {Severity M} | | | |
| b. Damaged or open joint/lap, obvious water penetration. | LF | | |
| *** {Severity H} | | | |
| c. Missing or loose end/top closure strips. | LF | | |
| *** {Severity H} | | | |
| * Fastener defects. | | | |
| Observation: | | | |
| a. Scattered, loose or missing fasteners, potential for panel damage. | SF | | |
| *** {Severity M} | | | |
| b. Loose or missing panel fasteners, panel damage immanent. | SF | | |
| *** {Severity H} | | | |

13.04 DOMES (BULK STORAGE)

COMPONENTS (Continued)

♦ 13.04.10 EXTERIOR COVERING - WOOD

Because of the shape of bulk storage domes, exterior wood wall covering is usually in the form of wood shingles.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Split, cracked, or missing shingles. | | | |
| Observation: | | | |
| a. Split or cracked shingles, no obvious water penetration. | SF | | |
| *** {Severity L} | | | |
| b. Split, cracked, or missing shingles, obvious water penetration. | SF | | |
| *** {Severity H} | | | |
| * Warped shingles. | | | |
| Observation: | | | |
| a. Warping of shingles, no obvious water penetration. | SF | | |
| *** {Severity L} | | | |
| b. Warping of shingles, obvious water penetration. | SF | | |
| *** {Severity H} | | | |
| * Loose or missing shingle nails. | | | |
| Observation: | | | |
| a. Loose or missing shingle nails. | SF | | |
| *** {Severity H} | | | |
| * Dried-out surface or lack of wood preservative. | | | |
| Observation: | | | |
| a. Dried-out surface or lack of wood preservative on shingle. | SF | | |
| *** {Severity M} | | | |

13.04 DOMES (BULK STORAGE)

REFERENCES

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994
2. NAVFAC MO-322, Inspection of Shore Facilities, 1993
3. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
4. NAVFAC MO-312, Wood Protection, 1990

13.04 DOMES (BULK STORAGE)

LEVEL II KEY GUIDE SHEET CONTROL NUMBER

1 GS-II 13.04.05-1

LEVEL III KEY GUIDE SHEET CONTROL NUMBER

| | |
|----|--------------------|
| 1 | GS-III 13.04.01-1 |
| 2 | GS-III 13.04.01-2 |
| 3 | GS-III 13.04.01-3 |
| 4 | GS-III 13.04.02-4 |
| 5 | GS-III 13.04.02-5 |
| 6 | GS-III 13.04.03-6 |
| 7 | GS-III 13.04.03-7 |
| 8 | GS-III 13.04.03-8 |
| 9 | GS-III 13.04.04-9 |
| 10 | GS-III 13.04.05-10 |
| 11 | GS-III 13.04.06-11 |
| 12 | GS-III 13.04.06-12 |
| 13 | GS-III 13.04.07-13 |
| 14 | GS-III 13.04.07-14 |

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: FRAMING - WOOD
CONTROL NUMBER: GS-II 13.04.05-1

Application

This guide applies to the investigation of deterioration of wood framing dome structures due to rot, fungus, decay or parasite damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area, using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer, in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick/pocket knife, to determine extent of damage due to insect infestation, rot or fungi damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: FOUNDATION/FLOORING - CONCRETE
CONTROL NUMBER: GS-III 13.04.01-1

Application

This guide applies to the investigation of cracks in concrete foundations or flooring.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: FOUNDATION/FLOORING - CONCRETE
CONTROL NUMBER: GS-III 13.04.01-2

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete foundations or flooring.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: FOUNDATION/FLOORING - CONCRETE
CONTROL NUMBER: GS-III 13.04.01-3

Application

This guide applies to the investigation of out of level of concrete foundations or flooring.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for uneven settlement by observing condition of surrounding surface area of concrete foundation or flooring.
2. Investigate past history of leak repair which can signify uneven hydrostatic pressures creating bulging settlement.
3. Check all sealant, expansion/contraction joints or mortar joints for deterioration which can allow water penetration.
4. Perform NDT, in this case ultrasonic pulse velocity test to compare structural integrity from one part of the foundation or floor to another and identify locations of cracks, breaks and other subsurface disintegration that could contribute to the out of level of the foundation or floor.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: FOUNDATION/FLOORING - BITUMINOUS COATED
CONTROL NUMBER: GS-III 13.04.02-4

Application

This guide applies to the investigation of cracks in bituminous coated concrete foundations or flooring.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: FOUNDATION/FLOORING - BITUMINOUS COATED
CONTROL NUMBER: GS-III 13.04.02-5

Application

This guide applies to the investigation of foundations or flooring with depressed soft areas or areas with deviation from level.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for uneven settlement by observing condition of surrounding surface area of foundation or flooring.
2. Investigate past history of leak repair which can signify uneven hydrostatic pressures creating bulging settlement.
3. Check all sealant, expansion/contraction joints or mortar joints for deterioration which can allow water penetration.
4. Perform NDT, in this case ultrasonic pulse velocity test to compare structural integrity from one part of the foundation or floor to another and identify locations of cracks, breaks and other subsurface disintegration that could contribute to depressed soft areas or areas with deviation from level.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: RETAINING WALLS
CONTROL NUMBER: GS-III 13.04.03-6

Application

This guide applies to the investigation of cracks in concrete retaining walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.
4. If footings are exposed, examine for cracks or breaks and take core samples for lab analysis to determine condition or strength of footing. Plug core holes with epoxy sealer after boring.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: RETAINING WALLS
CONTROL NUMBER: GS-III 13.04.03-7

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete retaining walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: RETAINING WALLS
CONTROL NUMBER: GS-III 13.04.03-8

Application

This guide applies to the investigation out of level deviations in concrete retaining walls.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for uneven settlement by observing condition of surrounding exterior grade or foundation slab.
2. Investigate past history of leak repair which can signify uneven hydrostatic pressures creating bulging settlement.
3. Check all sealant, expansion/contraction joints or mortar joints for deterioration which can allow water penetration.
4. Perform NDT, in this case ultrasonic pulse velocity test to compare structural integrity from one part of the retaining walls to another and identify locations of cracks, breaks and other subsurface disintegration that could contribute to out of level deviation in concrete retaining walls.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: FRAMING - METAL
CONTROL NUMBER: GS-III 13.04.04-9

Application

This guide applies to the investigation of cracks and cracked welds in metal framing members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean area (wire brush) to bare metal.
2. Apply dye, allow to penetrate, remove excess.
3. Apply developer, this draws the dye out and defines the extent and size of surface flaws.
4. Perform NDT, in this case high frequency ultrasonic inspection of the cracks to determine extent of subsurface damage.
5. Check any other suspect areas such as patches and repairs.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Wire brush
2. Dye penetrant and developer
3. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: FRAMING - WOOD
CONTROL NUMBER: GS-III 13.04.05-10

Application

This guide applies to the investigation of deterioration of wood framing members due to insect infestation, rot or fungi damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Sound with hammer.
2. Bore or core (should be angled to prevent water accumulation). Plug hole with treated dowels. Examine core at the site and send to laboratory for biological studies.
3. Test with a moisture meter.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. One-pound hammer
2. Increment borer
3. Moisture meter
4. Treated wood dowels

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. I and Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
3. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: FRAMING - CONCRETE
CONTROL NUMBER: GS-III 13.04.06-11

Application

This guide applies to the investigation of cracks in concrete framing members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: FRAMING - CONCRETE
CONTROL NUMBER: GS-III 13.04.06-12

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete framing members.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environment conditions, specifically chemical attack. Document conditions.
2. Check for improper design or construction conditions for inadequate concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment.

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: EXTERIOR COVERING - CONCRETE
CONTROL NUMBER: GS-III 13.04.07-13

Application

This guide applies to the investigation of cracks in concrete exterior covering over domes.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

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Inspection Actions

1. Check general appearance for any conditions that may cause cracking or surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: EXTERIOR COVERING - CONCRETE
CONTROL NUMBER: GS-III 13.04.07-14

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete exterior covering over domes.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environment conditions, specifically chemical attack. Document conditions.
2. Check for improper design or construction conditions for inadequate concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell. These readings are taken on a grid basis and converted into potential gradient mapping.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment.

Recommended Inspection Frequency

Perform inspection when triggered by Level I and Level II inspections or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

13.05 CEMETERIES

DESCRIPTION

Cemeteries is a subsystem of the Grounds and Miscellaneous Structures System. A Cemetery is an area designated for the burial of the dead. The burial may be below ground or above in vaults or mausoleums. The grave sites in traditional cemeteries are marked with monuments and in memorial parks with plaques flush with the ground and both containing names, dates and other inscriptions.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of Cemeteries, beyond the requirements listed in the Standard Tools Section.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Cemeteries, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- ◆ 13.05.01 MONUMENTS/HEADSTONES/FOOTSTONES
- ◆ 13.05.02 FLUSH MOUNTED PLAQUES/STONES
- ◆ 13.05.03 GRAVE SITES

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

13.06 LANDSCAPING

13.05 CEMETERIES

STANDARD INSPECTION PROCEDURE

This subsystem requires a Level I inspection as part of the basic inspection process. Associated defects and observations, for each major component, are listed in the inspector's field recording device.

The most common defects noted are tilting monuments, damaged monument surfaces, missing monument components, flush plaque parts and fasteners, depressed earth cover over grave sites and poorly graded turf areas.

COMPONENTS

◆ 13.05.01 MONUMENTS/HEADSTONES/FOOTSTONES

Monuments, headstones, and footstones are decorative stone, marble or other masonry structures marring a traditional style grave site. They include a foundation, superstructure, sculpture and a plaque or engravings containing various inscriptions.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Settlement. | | | |
| Observation: | | | |
| a. Monument out of plumb less than or equal to 3" within 10'. | EA | | |
| *** {Severity M} | | | |
| b. Monument out of plumb greater than 3" within 10'. | EA | | |
| *** {Severity H} | | | |
| * Cracking. | | | |
| Observation: | | | |
| a. Cracking not significantly affecting the strength or aesthetic value. | SF | | |
| *** {Severity L} | | | |
| b. Cracking moderately affecting the strength and/or aesthetic value. | SF | | |
| *** {Severity M} | | | |
| c. Cracking significantly affecting the strength and/or aesthetic value. | SF | | |
| *** {Severity H} | | | |

13.05 CEMETERIES

COMPONENTS (Continued)

♦ 13.05.01 MONUMENTS/HEADSTONES/FOOTSTONES (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Spalling, scaling. | | | |
| Observation: | | | |
| a. Spalling or scaling not significantly effecting the strength or aesthetic value. | SF | | |
| *** {Severity L} | | | |
| b. Spalling or scaling moderately effecting strength and/or aesthetic value. | SF | | |
| *** {Severity M} | | | |
| c. Spalling or scaling significantly effecting the strength or aesthetic value. | SF | | |
| *** {Severity H} | | | |
| * Damaged plaque or inscription. | | | |
| Observation: | | | |
| a. Marred, worn or abraded plaque surface, insignificant effect on legibility or aesthetic value. | EA | | |
| *** {Severity L} | | | |
| b. Loose plaque fasteners | EA | | |
| *** {Severity L} | | | |
| c. Missing or damaged plaque fasteners, | EA | | |
| *** {Severity H} | | | |
| d. Marred, worn or abraded sculptured inscriptions, significant effect on legibility or aesthetic value. | SF | | |
| *** {Severity H} | | | |
| e. Missing or damaged removable monument accessories. | EA | | |
| *** {Severity H} | | | |
| f. Vegetation on monument invading joints. | SF | | |
| *** {Severity H} | | | |

13.05 CEMETERIES

COMPONENTS (Continued)

♦ 13.05.01 MONUMENTS/HEADSTONES/FOOTSTONES (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Missing, separated or cracked joint sealant/caulk. | | | |
| Observation: | | | |
| a. Deteriorated joint sealant/caulk, no obvious water penetration. | LF | | |
| *** {Severity M} | | | |
| b. Deteriorated joint sealant/caulk, obvious water penetration. | LF | | |
| *** {Severity H} | | | |

13.05 CEMETERIES

COMPONENTS (Continued)

♦ 13.05.02 FLUSH MOUNTED PLAQUES/STONES

Flush mounted plaques/stones are decorative bronze, marble or granite structures marking a memorial park style gravesite. They include a foundation with a bronze plaque attached or an inscribed granite or masonry unit, mounted flush with the ground.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Settlement. | | | |
| Observation: | | | |
| a. Plaque/stone settled below ground level less than or equal to 1". | EA | | |
| *** {Severity M} | | | |
| b. Plaque/stone settled below ground level greater than 1". | EA | | |
| *** {Severity H} | | | |
| * Cracking. | | | |
| Observation: | | | |
| a. Cracking not significantly effecting the strength or aesthetic value. | LF | | |
| *** {Severity L} | | | |
| b. Cracking moderately effecting the strength and/or aesthetic value. | LF | | |
| *** {Severity M} | | | |
| c. Cracking significantly effecting the strength and/or aesthetic value. | LF | | |
| *** {Severity H} | | | |
| * Spalling, scaling. | | | |
| Observation: | | | |
| a. Spalling or scaling not significantly effecting the strength or aesthetic value. | SF | | |
| *** {Severity L} | | | |
| b. Spalling or scaling moderately effecting strength and/or aesthetic value. | SF | | |
| *** {Severity M} | | | |
| c. Spalling or scaling significantly effecting the strength or aesthetic value. | SF | | |
| *** {Severity H} | | | |

13.05 CEMETERIES

COMPONENTS (Continued)

♦ 13.05.02 FLUSH MOUNTED PLAQUES/STONES (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Damaged plaque or inscription. | | | |
| Observation: | | | |
| a. Loose plaque fasteners. | EA | | |
| *** {Severity L} | | | |
| b. Marred, worn or abraded plaque sculpture, insignificant effect on legibility or aesthetic value. | SF | | |
| *** {Severity L} | | | |
| c. Marred, worn or abraded plaque surface, insignificant effect on legibility or aesthetic value. | EA | | |
| *** {Severity L} | | | |
| d. Missing or damaged plaque fasteners, | EA | | |
| *** {Severity M} | | | |

13.05 CEMETERIES

COMPONENTS (Continued)

◆ 13.05.03 GRAVE SITE

The grave site is that area directly above the burial vault, usually about 3' X 8', which has been excavated and backfilled to facilitate body interment.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Defective turf cover. | | | |
| Observation: | | | |
| a. Turf cover dead or dying. | SF | | |
| *** {Severity L} | | | |
| b. Turf cover thin, minor erosion apparent. | SF | | |
| *** {Severity M} | | | |
| c. Turf cover missing, significant unsightly erosion present. | SF | | |
| *** {Severity H} | | | |
| * Defective grading. | | | |
| Observation: | | | |
| a. Earth cover settled less than or equal to 1/2" below surrounding area, ponding water not evident. | SF | | |
| *** {Severity L} | | | |
| b. Earth cover settled greater than 1/2" below surrounding area, ponding water not evident. | SF | | |
| *** {Severity M} | | | |
| c. Earth cover settled with obvious ponding of water. | SF | | |
| *** {Severity H} | | | |

13.05 CEMETERIES

REFERENCES

1. James R. Sperling, Tidewater Cemetery Corp., Virginia Beach, VA
2. Margaret M. Phillips, Doleman's Memorials Inc., Portsmouth, VA

13.05 CEMETERIES

| LEVEL II KEY | GUIDE SHEET CONTROL NUMBER |
|---------------------|-----------------------------------|
|---------------------|-----------------------------------|

N/A

| LEVEL III KEY | GUIDE SHEET CONTROL NUMBER |
|----------------------|-----------------------------------|
|----------------------|-----------------------------------|

N/A

13.06 LANDSCAPING

DESCRIPTION

Landscaping is a subsystem of the Grounds and Miscellaneous Real Property Structures System. Landscaping is comprised of the topography, vegetation and watering systems in the area immediately adjacent (200 FT) to a facility, as well as "common" grounds maintained between facilities. This does not include natural preserves, reforested areas or parklands.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of Landscaping, beyond the requirements listed in the Standard tools Section.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Landscaping, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- ◆ 13.06.01 TOPOGRAPHY
- ◆ 13.06.02 LAWNS, GRASSES, GROUND COVER AND PLANTING BEDS
- ◆ 13.06.03 TREES, SHRUBS AND VINES
- ◆ 13.06.04 SPRINKLER SYSTEMS
- ◆ 13.06.05 IRRIGATION SYSTEMS

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following should be reviewed for concurrent inspection activities.

13.05 CEMETERIES

13.06 LANDSCAPING

STANDARD INSPECTION PROCEDURE

This subsystem requires Level I inspection as part of the basic inspection process. Associated defects and observations, for each major component, are listed in the inspectors' Data Collection Devices.

COMPONENTS

♦ 13.06.01 TOPOGRAPHY

Topography defines the relief features or ground surface configuration of the area immediately adjacent to a facility, as well as "common" grounds maintained between facilities.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Improper drainage. | | | |
| Observation: | | | |
| a. Ponding, standing water or depression. | SF | | |
| *** {Severity M} | | | |
| * Wind erosion. | | | |
| Observation: | | | |
| a. Bald areas devoid of vegetation and/ or top soil. | SF | | |
| *** {Severity M} | | | |
| * Water erosion. | | | |
| Observation: | | | |
| a. Gullied or scoured areas devoid or vegetation and top soil. | SF | | |
| *** {Severity M} | | | |
| * Physical damage. | | | |
| Observation: | | | |
| a. Worn, depressed, hard patched ground areas devoid of vegetation. | SF | | |
| *** {Severity M} | | | |
| b. Tire ruts, vehicular damage. | SF | | |
| *** {Severity H} | | | |

13.06 LANDSCAPING

COMPONENTS (Continued)

◆ 13.06.02 LAWNS, GRASSES, GROUND COVER AND PLANTING BEDS

Lawns are established stands of grass normally used for ground cover. Broad leafed plants that form a relatively flat, ground-hugging mat are used to provide ground cover. Planting beds are normally maintained for special plants.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Damaged vegetation. | | | |
| Observation: | | | |
| a. Dying (brown), dwarfing, underdeveloped, sparse. | SF | | 1 |
| *** {Severity M} | | | |
| b. Insect infestation/damaged. | SF | | 1 |
| *** {Severity M} | | | |
| c. Weed infestation. | SF | | |
| *** {Severity M} | | | |
| * Uneven coverage. | | | |
| Observation: | | | |
| a. Mowed to close, less than 1 1/2" | SF | | |
| *** {Severity L} | | | |
| b. Leaf and debris accumulation in planting beds. | SF | | |
| *** {Severity M} | | | |

13.06 LANDSCAPING

COMPONENTS (Continued)

◆ 13.06.03 TREES, SHRUBS AND VINES

Trees, shrubs and vines are located by design or left growing in situ for enhancement of the aesthetics of a facility. Trees also provide shade and act as a windbreak.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Diseased/ rotted/damaged | | | |
| Observation: | | | |
| a. Dying, defoliating stems or branches. | EA | | 2 |
| *** {Severity M} | | | |
| b. Trunk losing bark, rotting, bleeding, split or broken. | EA | | 2 |
| *** {Severity M} | | | |
| c. Uprooted, or trunk rotted greater than 25 percent of diameter. | EA | | 2 |
| *** {Severity H} | | | |

13.06 LANDSCAPING

COMPONENTS (Continued)

◆ 13.06.04 SPRINKLER SYSTEMS

A sprinkler system is a network of pipes and spray heads that deliver water to a lawn or landscaped area. The system is an open pipe system that is normally activated by manually opening valves or an automatic controller and supplied from a normal water source or a pump and well.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Leaking pump. | | | |
| Observation: | | | |
| a. Leaking at pump, fittings or seals. | EA | | |
| *** {Severity M} | | | |
| b. Cracked or damaged pump housing. | EA | | |
| *** {Severity H} | | | |
| * Excessive noise and vibration at pump. | | | |
| Observation: | | | |
| a. Rattling noise. | EA | | |
| *** {Severity M} | | | |
| b. Grinding noise, indicating metal to metal contact. | EA | | |
| *** {Severity H} | | | |
| * Damaged pump motor. | | | |
| Observation: | | | |
| a. Cracked/damaged housing or end bells. | EA | | |
| *** {Severity H} | | | |
| b. Broken motor base. | EA | | |
| *** {Severity H} | | | |
| * Defective electrical connectors. | | | |
| Observation: | | | |
| a. Loose conduit or connectors. | EA | | |
| *** {Severity M} | | | |
| b. Exposed wires or missing cover plates. | EA | | |
| *** {Severity H} | | | |

13.06 LANDSCAPING

COMPONENTS (Continued)

♦ 13.06.04 SPRINKLER SYSTEMS (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Defective valve. | | | |
| Observation: | | | |
| a. Broken or missing valve handle. | EA | | |
| *** {Severity L} | | | |
| b. Bent stem. | EA | | |
| *** {Severity M} | | | |
| c. Damaged or missing valve solenoid. | EA | | |
| *** {Severity M} | | | |
| d. Leaking valve packing glands/gaskets. | EA | | |
| *** {Severity M} | | | |
| e. Cracked valve body, leaking. | EA | | |
| *** {Severity H} | | | |
| * Defective fitting. | | | |
| Observation: | | | |
| a. Bent or cracked fitting, not leaking. | EA | | |
| *** {Severity L} | | | |
| b. Water dripping. | EA | | |
| *** {Severity M} | | | |
| c. Damaged/defective sprinkler heads. | EA | | |
| *** {Severity H} | | | |
| * Defective pipe. | | | |
| Observation: | | | |
| a. Bent or cracked pipe, not leaking. | LF | | |
| *** {Severity L} | | | |
| b. Water dripping. | LF | | |
| *** {Severity M} | | | |
| * Physically damaged control panel. | | | |
| Observation: | | | |
| a. Physically damaged control panel enclosure. | EA | | |
| *** {Severity M} | | | |
| b. Burned out pilot lamps. | EA | | |
| *** Severity F} | | | |
| c. Control panel blocked, not accessible for inspection. | EA | | |
| *** {Severity S} | | | |

13.06 LANDSCAPING

COMPONENTS (Continued)

♦ 13.06.04 SPRINKLER SYSTEMS (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Defective valve control timer. | | | |
| Observation: | | | |
| a. Timer not connected to electrical source. | EA | | |
| *** {Severity L} | | | |
| * Corrosion at pump. | | | |
| Observation: | | | |
| a. Surface corrosion no pitting evident. | EA | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | EA | | |
| *** {Severity M} | | | |
| c. Corrosion evidenced by holes or loss of base metal. | EA | | |
| *** {Severity H} | | | |

13.06 LANDSCAPING

COMPONENTS (Continued)

♦ 13.06.05 IRRIGATION SYSTEMS

An irrigation system may be employed to provide and spread water throughout a level area. The irrigation system consist of gates, flow controls and turnouts to divert and control the quantity of the water that is to be delivered throughout the area.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Defective water flow. | | | |
| Observation: | | | |
| a. Silted or overgrown channels. | LF | | |
| *** {Severity M} | | | |
| b. Eroded delivery channel banks. | LF | | |
| *** {Severity H} | | | |
| * Defective gate, flow control or turnout. | | | |
| Observation: | | | |
| a. Inoperable gate, flow control or turnout. | EA | | |
| *** {Severity M} | | | |
| b. Broken or missing gate, flow control or turnout. | EA | | |
| *** {Severity H} | | | |

13.06 LANDSCAPING

REFERENCES

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988.
2. NAVFAC MO-322, Vol. II Inspection of Shore Facilities, 1993
3. American Water Works Association, Manual of Water Supply Practices, M-36, 1990.
4. NAVFAC P-717.0, Department of Defense, Engineered Performance Standards for Real Property Maintenance Activities.
5. Uniform Plumbing Code, International Association of Plumbing and Mechanical Officials.
6. NAVFAC MO-322, Vol. I, Maintenance Inspection and Service Checklists, 1993
7. NAVFAC MO-312, Wood Protection, 1990

13.06 LANDSCAPING

LEVEL II KEY GUIDE SHEET CONTROL NUMBER

N/A

LEVEL III KEY GUIDE SHEET CONTROL NUMBER

| | |
|---|-------------------|
| 1 | GS-III 13.06.02-1 |
| 2 | GS-III 13.06.03-2 |

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: LAWNS, GRASSES, GROUND COVER AND PLANTING BEDS
CONTROL NUMBER: GS-III 13.06.02-1

Application

The guide applies to the investigation of diseased or insect damaged lawns, grasses, ground cover and planting beds.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Take representative soil samples for lab analysis to determine needed corrective action, conditioning amendments and fertilizer materials to bring soil to desired standards.
2. Take representative samples from grass, lawn or ground cover areas as required for lab analysis to determine type of disease or infestation present and required corrective action. To bring to desired standards.

Special Tools and Equipment

The following is a list of special tools and equipment, beyond the requirements listed in the Standard Tool Section.

1. Soil sample tool
2. Soil sample containers
3. Pruning shears
4. Large plastic sample bags

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: TREES, SHRUBS AND VINES
CONTROL NUMBER: GS-III 13.06.03-2

Application

The guide applies to the investigation of diseased or insect damaged trees, shrubs and vines.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Take representative soil samples for lab analysis to determine needed corrective action conditioning amendments and fertilizer materials to bring soil to desired standards.
2. Take representative core samples from trees, shrubs or vines as required for lab analysis to determine type of disease or infestation present and required corrective action. To bring to desired standards.
3. If wood core samples are taken plug and seal core holes.

Special Tools and Equipment

The following is a list of special tools and equipment, beyond the requirements listed in the Standard Tool Section.

1. Soil sample tool
2. Soil sample containers
3. Pruning shears
4. Wood core boring tool
5. Large plastic sample bags

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. NAVFAC MO-322, Vol.II, Inspection of Shore Facilities, 1993
2. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

13.07 FLAGPOLES

DESCRIPTION

Flagpoles is a subsystem of the Grounds and Miscellaneous Structures System. A ground set flagpole is a pole that is set in the ground at a prominent location so that a flag, banner or emblem may be raised and displayed.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Flagpoles:

1. Scraper
2. Brush
3. Ice pick or pocket knife
4. Hammer
5. Calipers
6. Measuring scale

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Flagpoles, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- ◆ 13.07.01 FLAGPOLES - WOOD
- ◆ 13.07.02 FLAGPOLES - METAL
- ◆ 13.07.03 FLAGPOLES - CONCRETE
- ◆ 13.07.04 FLAGPOLES - FIBERGLASS
- ◆ 13.07.05 FLAGPOLE BASES - CONCRETE
- ◆ 13.07.06 FLAGPOLE ACCESSORIES

RELATED SUBSYSTEMS

There are no related subsystems.

13.07 FLAGPOLES

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspector's Data Collection Devices.

COMPONENTS

◆ 13.07.01 FLAGPOLES - WOOD

A ground set wood flagpole is normally set in a concrete base. Flagpoles out of plumb may be checked by eye sight or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Splits/cracking/broken. | | | |
| Observation: | | | |
| a. Surface fibers separated less than 25 percent of diameter affected. | LF | | |
| *** {Severity M} | | | |
| b. Surface fibers separated, greater than 25 percent of diameter affected. | LF | | |
| *** {Severity H} | | | |
| c. Physically damaged or broken. | LF | | |
| *** {Severity H} | | | |
| * Rot, fungus or decay. | | | |
| Observation: | | | |
| a. Moist stained area. | LF | | |
| *** {Severity M} | | | |
| b. Discolored, soft or crushed area. | LF | 1 | |
| *** {Severity H} | | | |
| * Parasite damage. | | | |
| Observation: | | | |
| a. Holes less than 1/8" Dia, surface sag, and frass observed. | LF | 1 | |
| *** {Severity M} | | | |
| b. Large holes greater than 1/8" Dia, surface channels, punctures, and crushing. | LF | 1 | |
| *** {Severity H} | | | |

13.07 FLAGPOLES

COMPONENTS (Continued)

♦ 13.07.01 FLAGPOLES - WOOD (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|-------------------------------------|-----|-----------------|------------------|
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 6" in 20'. | EA | | |
| *** {Severity M} | | | |
| b. More than 6" in 20'. | EA | | |
| *** {Severity H} | | | |

13.07 FLAGPOLES

COMPONENTS (Continued)

♦ 13.07.02 FLAGPOLES - METAL

A ground set metal flagpole is normally set in a concrete base. Flagpoles out of plumb may be checked by eyesight or transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 6" in 20'. | EA | | |
| *** {Severity M} | | | |
| b. More than 6" in 20'. | EA | | |
| *** {Severity H} | | | |
| * Corrosion. | | | |
| Observation: | | | |
| a. Surface corrosion no pitting evident. | LF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | LF | | |
| *** {Severity M} | | | |
| c. Rust/corrosion evidenced loss of base metal. | LF | | |
| *** {Severity H} | | | |

13.07 FLAGPOLES

COMPONENTS (Continued)

♦ 13.07.03 FLAGPOLES - CONCRETE

A ground set concrete flagpole is precast and either reinforced or prestressed and is normally set in a concrete base. Flagpoles out of plumb may be checked by eyesight or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline crack. | LF | | |
| *** {Severity L} | | | |
| b. Medium cracks 1/16" wide. | LF | | |
| *** {Severity L} | | | |
| c. Wide cracks more than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| d. Disintegration of concrete surfaces, with loss of surface exceeding depth of 2". | LF | | |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | LF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter. | LF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area, with corrosion of exposed reinforcing steel. | LF | | |
| *** {Severity H} | | | |
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | LF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep with coarse aggregates clearly exposed. | LF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeds 1", reinforcing steel usually exposed. | LF | | |
| *** {Severity H} | | | |

13.07 FLAGPOLES

COMPONENTS (Continued)

♦ 13.07.03 FLAGPOLES - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | LF | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 6" in 20'. | EA | | |
| *** {Severity M} | | | |
| b. More than 6" in 20'. | EA | | |
| *** {Severity H} | | | |

13.07 FLAGPOLES

COMPONENTS (Continued)

♦ 13.07.04 FLAGPOLES - FIBERGLASS

A ground set fiberglass flagpole is normally set in a concrete base. Flagpoles out of plumb may be checked by eyesight or by transit.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Splits/cracks/broken. | | | |
| Observation: | | | |
| a. Surface fibers separated, less than or equal to 1/4" deep. | LF | | |
| *** {Severity M} | | | |
| b. Surface fibers separated, greater than 1/4" deep. | LF | | |
| *** {Severity H} | | | |
| c. Physically damaged and broken. | LF | | |
| *** {Severity H} | | | |
| * Delamination of pole surface. | | | |
| Observation: | | | |
| a. Surface delamination less than or equal to 1/8" deep. | LF | | |
| *** {Severity M} | | | |
| b. Delamination greater than 1/8" deep. | LF | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 6" in 20'. | EA | | |
| *** {Severity M} | | | |
| b. More than 6" in 20'. | EA | | |
| *** {Severity H} | | | |

13.07 FLAGPOLES

COMPONENTS (Continued)

♦ 13.07.05 FLAGPOLE BASES - CONCRETE

Concrete flagpole bases are cast in place to a specific design requirement.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline crack. | SF | | |
| *** {Severity L} | | | |
| b. Medium cracks 1/16" wide. | SF | | |
| *** {Severity L} | | | |
| c. Wide cracks more than 1/16" wide. | SF | | 1 |
| *** {Severity M} | | | |
| d. Disintegration of concrete surfaces, with loss of surface exceeding depth of 2". | SF | | 1 |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | SF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter. | SF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area, with corrosion of exposed reinforcing steel. | SF | | 2 |
| *** {Severity H} | | | |
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | SF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep with coarse aggregates clearly exposed. | SF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeds 1", reinforcing steel usually exposed. | SF | | 2 |
| *** {Severity H} | | | |

13.07 FLAGPOLES

COMPONENTS (Continued)

♦ 13.07.05 FLAGPOLE BASES - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | SF | | 2 |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion at edge of flagpole base. | SF | | |
| *** {Severity M} | | | |

13.07 FLAGPOLES

COMPONENTS (Continued)

♦ 13.07.06 FLAGPOLE ACCESSORIES

As a minimum flagpole accessories will include a halyard and snaps, a pulley truck or stationary pulley at the top of the pole and a cleat to secure the halyard near the base of the pole. In addition, pole accessories may include a pole top ball, gaff with pulley and separate halyard, yardarm with two pulleys and halyards, halyard shock spring, halyard counterweight, handhold door on hollow metal or fiberglass poles and a pole base flash collar.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Defective halyard. | | | |
| Observation: | | | |
| a. Frayed halyard. | EA | | |
| *** {Severity M} | | | |
| b. Broken halyard. | EA | | |
| *** {Severity H} | | | |
| c. Missing halyard. | EA | | |
| *** {Severity H} | | | |
| * Damaged or missing accessory (other than halyard). | | | |
| Observation: | | | |
| a. Physically damaged. | EA | | |
| *** {Severity M} | | | |
| b. Missing. | EA | | |
| *** {Severity H} | | | |

13.07 FLAGPOLES

REFERENCES

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990
3. NAVFAC MO-322, Vol.II, Inspection of Shore Facilities, 1993
4. PLP Composite Technologies, Inc., 10350/PLP/Buyline 0303, 1993

13.07 FLAGPOLES

LEVEL II KEY GUIDE SHEET CONTROL NUMBER

1 GS-II 13.07.01-1

LEVEL III KEY GUIDE SHEET CONTROL NUMBER

1 GS-III 13.07.05-1

2 GS-III 13.07.05-2

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: FLAGPOLES - WOOD
CONTROL NUMBER: GS-II 13.07.01-1

Application

This guide applies to the investigation of possible deterioration of the exterior surface of wood flagpoles due to rot, fungi decay or parasite damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area, using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer, in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick/pocket knife, to determine extent of damage due to insect infestation, rot or damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: FLAGPOLE BASES - CONCRETE
CONTROL NUMBER: GS-III 13.07.05-1

Application

This guide applies to the investigation of cracks in concrete flagpole bases.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check general appearance for any conditions that may cause cracking of surface deterioration.
2. Examine cracking to determine if cracks are active or dormant. Document the location, pattern, depth, width and length.
3. Perform NDT, in this case ultrasonic pulse velocity inspection of the cracks to determine extent of subsurface damage.
4. Document the problem and contact appropriate facility personnel for further instructions.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Ultrasonic pulse velocity equipment
2. Concrete/masonry core boring equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: FLAGPOLE BASES - CONCRETE
CONTROL NUMBER: GS-III 13.07.05-2

Application

This guide applies to the investigation of corrosion of exposed reinforcing steel in concrete flagpole bases.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Check for exposure and environmental conditions, specifically chemical attack. Document conditions.
2. Check for adequacy of concrete cover to protect it from corrosion. Document location and thickness of cover.
3. Perform NDT to determine corrosion activity, in this case a copper sulfate half-cell.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tool Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Perform inspection when triggered by Level I inspection or other local factors such as problematic conditions.

References

1. Means Concrete Repair and Maintenance, Peter H. Emmons, 1994

13.08 SIGNAGE

DESCRIPTION

Signage is a subsystem of the Grounds and Miscellaneous Structures System. Signage is used to provide graphic presentation of direction, identification, information, regulation warning or restriction. Signs are constructed of wood, metal, concrete, masonry/stone or various combinations of these materials.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

The following special tools and equipment, beyond the requirements listed in the Standard Tool Section, are required to perform the inspection of Signage:

1. Scraper
2. Brush
3. Ice pick or pocket knife
4. Hammer
5. Calipers
6. Measuring scale

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of Signage, beyond the requirements listed in the Master Safety Plan and System Safety Section.

COMPONENT LIST

- ◆ 13.08.01 SIGNAGE - WOOD
- ◆ 13.08.02 SIGNAGE - METAL
- ◆ 13.08.03 SIGNAGE - CONCRETE
- ◆ 13.08.04 SIGNAGE - MASONRY/STONE

RELATED SUBSYSTEMS

There are no related subsystems.

13.08 SIGNAGE

STANDARD INSPECTION PROCEDURE

This subsystem requires both Level I and Level II inspections as part of the basic inspection process. Additional Level II inspections may be indicated or "triggered" by the Level I inspection observations and should be accomplished by the inspector at that time. Associated defects and observations, for each major component, are listed in the inspector's Data Collection Devices.

COMPONENTS

◆ 13.08.01 SIGNAGE - WOOD

A wood sign consists of one or more wood posts embedded in the ground with a wood or metal sign face secured to the post. Signs out of level or out of plumb may be checked by eye sight, string line or transit and proper orientation should be checked.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Loose, damaged, illegible or missing sign face. | | | |
| Observation: | | | |
| a. Loose sign face. | EA | | |
| *** {Severity L} | | | |
| b. Damaged sign face. | EA | | |
| *** {Severity M} | | | |
| c. Illegible sign face. | EA | | |
| *** {Severity M} | | | |
| d. Missing sign face. | EA | | |
| *** {Severity H} | | | |
| * Splits/cracks/broken posts. | | | |
| Observation: | | | |
| a. Surface fibers separated, less than than 25 percent of thickness affected. | LF | | |
| *** {Severity M} | | | |
| b. Surface fibers separated, greater than 25 percent of thickness affected. | LF | | |
| *** {Severity H} | | | |
| c. Physically damaged and broken. | LF | | |
| *** {Severity H} | | | |
| * Rot, fungus or decay of posts. | | | |
| Observation: | | | |
| a. Moist stained area. | LF | | |
| *** {Severity M} | | | |
| b. Discolored, soft or crushed area. | LF | 1 | |
| *** {Severity H} | | | |

13.08 SIGNAGE

COMPONENTS (Continued)

♦ 13.08.01 SIGNAGE - WOOD (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Parasite damage of posts. | | | |
| Observation: | | | |
| a. Holes less than 1/8", surface, sag, and frass observed. | LF | 1 | |
| *** {Severity M} | | | |
| b. Large holes greater than 1/8", surface channels, punctures, and crushing. | LF | 1 | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 4'. | EA | | |
| *** {Severity M} | | | |
| b. More than 3" in 4'. | EA | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 8'. | EA | | |
| *** {Severity M} | | | |
| b. More than 3" in 8'. | EA | | |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion around posts. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or obscuring sign. | SF | | |
| *** {Severity M} | | | |

13.08 SIGNAGE

COMPONENTS (Continued)

♦ 13.08.02 SIGNAGE - METAL

A metal sign consists of one or more pipe/metal posts, usually set in concrete, with a wood or metal sign face secured to the posts. Signs out of level or out of level or out of plumb may be checked by eyesight, string line or transit and proper orientation should be checked.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Loose, damaged, illegible or missing sign face. | | | |
| Observation: | | | |
| a. Loose sign face. | EA | | |
| *** {Severity L} | | | |
| b. Damaged sign face. | EA | | |
| *** {Severity M} | | | |
| c. Illegible sign face. | EA | | |
| *** {Severity M} | | | |
| d. Missing sign face. | EA | | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 4'. | EA | | |
| *** {Severity M} | | | |
| b. More than 3" in 4'. | EA | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 8'. | EA | | |
| *** {Severity M} | | | |
| b. More than 3" in 8'. | EA | | |
| *** {Severity H} | | | |
| * Corrosion of posts. | | | |
| Observation: | | | |
| a. Surface corrosion no pitting evident. | LF | | |
| *** {Severity L} | | | |
| b. Corrosion evidenced by pitting or blistering. | LF | | |
| *** {Severity M} | | | |
| c. Rust/corrosion evidenced loss of base metal. | LF | | |
| *** {Severity H} | | | |

13.08 SIGNAGE

COMPONENTS (Continued)

♦ 13.08.02 SIGNAGE - METAL (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion around posts. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or obscuring sign. | SF | | |
| *** {Severity M} | | | |

13.08 SIGNAGE

COMPONENTS (Continued)

♦ 13.08.03 SIGNAGE - CONCRETE

Concrete signs consists of one or more precast reinforced or prestressed posts which usually support either a metal or wood sign face. Signs out of level or out of plumb may be checked by eyesight, string line or transit, and proper orientation should be checked.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|---|-----|-----------------|------------------|
| * Loose, damaged, illegible or missing sign face. | | | |
| Observation: | | | |
| a. Loose sign face. | EA | | |
| *** {Severity L} | | | |
| b. Damaged sign face. | EA | | |
| *** {Severity M} | | | |
| c. Illegible sign face. | EA | | |
| *** {Severity M} | | | |
| d. Missing sign face. | EA | | |
| *** {Severity H} | | | |
| * Cracking. | | | |
| Observation: | | | |
| a. Hairline crack. | LF | | |
| *** {Severity L} | | | |
| b. Medium cracks 1/16" wide. | LF | | |
| *** {Severity L} | | | |
| c. Wide cracks more than 1/16" wide. | LF | | |
| *** {Severity M} | | | |
| d. Disintegration of concrete surfaces, with loss of surface exceeding depth of 2". | LF | | |
| *** {Severity H} | | | |
| * Spalling. | | | |
| Observation: | | | |
| a. Less than 1" deep or 6" in diameter. | LF | | |
| *** {Severity L} | | | |
| b. More than 1" in depth or greater than 6" in diameter, or loss of more than 10 percent of surface area of a member. | LF | | |
| *** {Severity H} | | | |
| c. Disintegration of surface area, with corrosion of exposed reinforcing steel. | LF | | |
| *** {Severity H} | | | |

13.08 SIGNAGE

COMPONENTS (Continued)

♦ 13.08.03 SIGNAGE - CONCRETE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Scaling. | | | |
| Observation: | | | |
| a. Loss of surface up to 1/2" deep, with exposure of coarse aggregates. | LF | | |
| *** {Severity L} | | | |
| b. Loss of surface from 1/2" to 1" deep with coarse aggregates clearly exposed. | LF | | |
| *** {Severity M} | | | |
| c. Loss of surface exceeds 1", reinforcing steel usually exposed. | LF | | |
| *** {Severity H} | | | |
| * Reinforcing steel corrosion. | | | |
| Observation: | | | |
| a. Rusting/discoloration evident, cracks occurring parallel to reinforcement. | LF | | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 4'. | EA | | |
| *** {Severity M} | | | |
| b. More than 3" in 4'. | EA | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 8'. | EA | | |
| *** {Severity M} | | | |
| b. More than 3" in 8'. | EA | | |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion around posts. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or obscuring sign. | SF | | |
| *** {Severity M} | | | |

13.08 SIGNAGE

COMPONENTS (Continued)

♦ 13.08.04 SIGNAGE - MASONRY/STONE

Masonry/stone signs normally have a concrete footing to support the brick, CMU or stone structures. Signs out of level or out of plumb may be checked by eyesight, string line or by transit and proper orientation should be checked. The masonry/stone structure may be used to support a wood or metal sign face.

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Loose, damaged, illegible or missing sign face. | | | |
| Observation: | | | |
| a. Loose sign face. | EA | | |
| *** {Severity L} | | | |
| b. Damaged sign face. | EA | | |
| *** {Severity M} | | | |
| c. Illegible sign face. | EA | | |
| *** {Severity M} | | | |
| d. Missing sign face. | EA | | |
| *** {Severity H} | | | |
| * Deteriorated mortar joint material. | | | |
| Observation: | | | |
| a. Cracked mortar joint material. | SF | | |
| *** {Severity L} | | | |
| b. Loose/missing mortar joint material. | SF | | |
| *** {Severity H} | | | |
| * Out of level. | | | |
| Observation: | | | |
| a. Less than or equal to 2" in 8'. | EA | | |
| *** {Severity M} | | | |
| b. More than 2" in 8'. | EA | | |
| *** {Severity H} | | | |
| * Out of plumb. | | | |
| Observation: | | | |
| a. Less than or equal to 3" in 8'. | EA | | |
| *** {Severity M} | | | |
| b. More than 3" in 8'. | EA | | |
| *** {Severity H} | | | |

13.08 SIGNAGE

COMPONENTS (Continued)

♦ 13.08.04 SIGNAGE - MASONRY/STONE (Continued)

| Defect: | UOM | LEVEL II KEY | LEVEL III KEY |
|--|-----|-----------------|------------------|
| * Damage bricks, stones or CMU. | | | |
| Observation: | | | |
| a. Cracked, split, damaged. | SF | | |
| *** {Severity M} | | | |
| b. Loose, missing. | SF | | |
| *** {Severity H} | | | |
| * Erosion/vegetation. | | | |
| Observation: | | | |
| a. Soil erosion around sign footing. | SF | | |
| *** {Severity M} | | | |
| b. Vines, trees or shrubs climbing over or obscuring sign. | SF | | |
| *** {Severity M} | | | |

13.08 SIGNAGE

REFERENCES

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990
3. NAVFAC MO-322, Vol. II, Inspection of Shore Facilities, 1993

13.08 SIGNAGE

LEVEL II KEY GUIDE SHEET CONTROL NUMBER

1 GS-II 13.08.01-1

LEVEL III KEY GUIDE SHEET CONTROL NUMBER

N/A

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: SIGNAGE - WOOD
CONTROL NUMBER: GS-II 13.08.01-1

Application

This guide applies to the investigation of possible deterioration of the exterior surfaces of wood sign posts due to rot, fungi decay or parasite damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level II inspection beyond those listed in the Master Safety Plan and System Safety Section.

Inspection Actions

1. Clean affected area, using scraper and brush.
2. Utilize calipers and scales to determine an approximation of the area that has been lost due to deterioration.
3. Tap with hammer, in order to detect loss of interior material, evidenced by a hollow sound.
4. Probe with ice pick/pocket knife, to determine extent of damage due to insect infestation, rot or damage.

Recommended Inspection Frequency

Perform inspection when triggered by a Level I or other local factors such as problematic conditions.

References

1. Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988
2. NAVFAC MO-312, Wood Protection, 1990

APPENDIX A

ABBREVIATIONS

| | |
|-----------------------|---|
| AIC | American Institute of Chemists |
| CAIS | Condition Assessment Information System |
| CAS | Condition Assessment Survey |
| CERL | Civil Engineering Research Laboratory |
| CMU | Concrete Masonry Unit |
| CY | Cubic Yard |
| DCD | Data Collection Device |
| EA | Each |
| FT | Foot |
| GPM | Gallons Per Minute |
| GS | Guide Sheet |
| HP | Horse power |
| HR | Hour |
| IU | Inspection Unit |
| LF | Linear Foot |
| MBH | Thousands of BTU's per Hour |
| N/A | Not Applicable |
| NAVFAC- MO | Naval Facilities Manual of Operations |
| NDT | Non-Destructive Testing |
| O.C. | On Center |
| OS&Y | Outside Stem and Yoke |
| PM | Preventive Maintenance |

APPENDIX A

| | |
|-------------|-------------------------------|
| PVC | Polyvinyl Chloride |
| PE | Professional Engineer |
| PSF | Pounds per Square Foot |
| RPIL | Real Property Inventory List |
| SF | Square Foot |
| TM | Technical Manual |
| UOM | Unit Of Measurement |
| YRS | Years |
| WBS | Work Breakdown Structure |
| ° | Degrees of Temperature |
| °C | Degrees Centigrade |
| °F | Degrees Fahrenheit |
| = | Equals |
| ' | Feet |
| > | Greater Than |
| ≥ | Greater Than or Equal To |
| " | Inches |
| < | Less Than |
| ≤ | Less Than or Equal To |
| / | Per or Over |
| % | Percent |
| + | Plus or Positive or Add |
| ± | Plus or Minus |
| - | Subtract or Minus or Negative |

APPENDIX A

• Times or By

x Times or By

APPENDIX B

GLOSSARY

| | |
|-------------|---|
| Abrade | To wear away or scrape off a surface, especially by friction. |
| Aesthetic | Of beauty, sensitive to art and beauty; showing good taste; artistic. |
| Aggregate | An inert granular material such as natural sand and gravel; which when bound together into a mass by a matrix forms concrete or mortar. |
| Alignment | An aligning or arrangement in a straight line; a ground plan , as of a field work , railroad etc. |
| Anchorage | A device used to attach the structural members to the building frame. |
| Anchor Rods | A threaded metal rod used with various types of hangers to support duct work, piping, etc. |
| Barbed Wire | Two or more wires twisted together with sharp hooks or points (or a single wire furnished with barbs) used for fences. |
| Beam | A structural member whose prime function is to carry transverse loads, as a joist, girder, rafter, or purlin. |
| Bituminous | Having to do with a semisolid mixture of hydrocarbons derived from coal or petroleum, as coal-tar pitch or asphalt; before application, usually dissolved in a solvent, emulsified, or heated, to a liquid state. |
| Braces | A metal or wood member which is used to stiffen or support a structure; a strut which supports or fixes another member in position or a tie used for the same purpose. |
| Calipers | An instrument, resembling a pair of dividers, with adjustable legs for measuring the diameter or thickness of bodies. |
| Caulk | A resilient mastic compound often having a silicone, bituminous, or rubber base; used to seal cracks, fill joints, prevent leakage, and or provide waterproofing. |
| Centrifugal | Moving or tending to move away from a center (conveying away from a center). |

APPENDIX B

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| Chain Link | A fence made of heavy steel wire fabric which is interwoven in such a way as to provide a continuous mesh without ties or knots. |
| Circumferential | Refers to the line bounding a circle. |
| Cleats | A small block or strip of wood nailed on a member or on a surface; used to support a brace or to hold a member or object in place. |
| Concertina Wire | A barbed wire coiled for easier handling and emplacement; when uncoiled it forms an entanglement. |
| Concurrent | Occurring at the same time. Meeting in or going toward the same point; converging. |
| Conical | Resembling or shaped like a cone (a solid with a circle for its base and a curved surface tapering evenly to an apex so that any point on this surface is in a straight line between the circumference of the base and its apex. |
| Coping | A protective cap, top, or cover of wall, parapet, pilaster, or chimney; often of stone, terra-cotta, concrete, metal, or wood. May be flat, but commonly sloping, double beveled, or curved to shed water so as to protect masonry from penetration of water from above. Most effective if extended beyond wall face and cut with a drip. |
| Corrosion | The deterioration of metal or of concrete by chemical or electrochemical reaction resulting from exposure to weathering, moisture, or chemicals, or other agents in the environment in which it is placed. |
| Crazing | Fine, random cracks or fissures in a network on or under a surface of plaster, cement, mortar, concrete, ceramic coating, or paint film caused by shrinkage. |
| Cycle (N)(V) | A period of time within which a round of regularly recurring events or phenomena is completed. |
| Dead Load | The weight of a structure itself, including the weight of fixtures or equipment permanently attached to it. |

APPENDIX B

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| Deadman | A buried concrete block, log, plate, or the like, which serves as an anchorage, for example, as an anchor for a tie to a retaining wall; depends on its own weight and passive pressure from the soil to hold it in place. |
| Decay | A deterioration or decomposing as of vegetable matter. |
| Delamination | A failure in a laminated structure characterized by the separation or loss of adhesion between plies, as in built-up roofing. |
| Density | The degree of aggregation; the quantity of any entity distributed over an area (for example, pounds per cubic foot). |
| Deviation | The act of turning aside; a sharp divergence from normal behavior. The deflection of a structural member. |
| Dielectric | A nonconductor of electricity; an insulator or insulating material. |
| Dielectric Union | A pipe fitting that is used to connect the ends of two pipes, neither of which can be turned; it consists of three pieces, the two end pieces (having inner threads), which are tightened around the pipe ends to be joined, and a center piece, which draws the two end pieces together as it is rotated, effecting a seal. It is made of material which contains an electrical insulator; which is used to prevent a electrolytic reaction and thus prevent corrosion. |
| Disintegration | Of concrete or the like, the deterioration into small fragments or particles. |
| Displacement | The weight or volume of a fluid which otherwise would fill the space of a floating object. In structural terms the load of the building if not properly engineered, can result in settlement of the structure; this settlement is the result of the displacement of soil by the foundation or footing of the building which is pushing aside the surrounding soil. |
| Distortion | A twisting out of shape; something changing the usual or normal shape. |
| Electrolysis | The decomposition of a chemical compound into its constituent elements by the passage of an electric current; this action leads to the decomposition of metals. |

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| Elliptical | Of or pertaining to an ellipse, which is the locus of all points on the plane at which the sum of the distances from a fixed pair of points, the foci, is a given constant. Also, oval shaped. |
| Erosion | The deterioration brought about by the abrasive action of fluids or solids in motion. |
| Excavate | To remove earth from its natural position. |
| Fabricate | To make, build, construct, especially by assembling parts; to manufacture. |
| Flagstone | A flat stone, usually 1 to 4 inches thick, used as a stepping-stone or for terrace or outdoor paving; usually either naturally thin or split from rock that cleaves easily. |
| Flue | An incombustible and heat-resistant enclosed passage in a chimney to control and carry away products of combustion from a fireplace, furnace, or boiler to the outside air. |
| Flush | Having the surface or face even or level with the adjacent surface. |
| Footing | That portion of the foundation of a structure which transmits loads directly to the soil; used to spread the load over a greater area to prevent or reduce settling. |
| Foundation | Any part of a structure that serves to transmit the load to the earth or rock, usually below ground level; the entire masonry substructure. |
| Frass | A powdery residue in holes bored in wood by insects, usually by powder-post beetles. |
| Friction | The resistance to relative motion, sliding or rolling, of the surfaces of bodies in contact. |
| Fungus | Any of a large group, including molds, mildews, mushrooms, rusts, and smuts, which are parasites on living organisms or feed upon dead organic material, lack chlorophyll, true roots, stems, leaves; and reproduce by means of spores. |
| Gaff | A spar attached at an upward angle to a flagpole displaying an additional flag, banner, or emblem from the same flagpole. |

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| Galvanic Action | An electrochemical action which takes place when dissimilar metals are in contact in the presence of an electrolyte, resulting in corrosion. |
| Girders | A large or principal beam of steel, reinforced concrete, or timber; used to support concentrated loads at isolated points along its length. |
| Girts | In braced framing a horizontal member at intermediate level between columns, studs, or posts. One of the horizontal members, from column to column, which carry wall sheaths. |
| Gullies | A channel or hollow worn by running water; a small narrow ravine. |
| Guniting | A trademark for a concrete mixture sprayed under pressure over steel reinforcement, as in making swimming pools. |
| Grade | The ground elevation or level, contemplated or existing, at the outside edge of a building, or elsewhere at the building site. Or the slope of a line of pipe with reference to the horizontal. |
| Half-Cell Test | In electrochemical cells, the electrical potential developed by the overall cell reaction can be considered, for calculation purposes, as the sum of the potential developed at the anode and the potential developed at the cathode, each being a half-cell. This difference in potential can be detected by placing a copper/copper sulfate half-cell on the surface of the concrete and measuring the potential differences between the reinforcing steel and a wet sponge on the concrete surface. The reference cell connects the concrete surface to a high-impedance voltmeter, which is also connected electrically to the reinforcing steel mat. |
| Halyard | A line used to hoist a flag, banner or emblem. |
| Housing | In a pump, motor, or fan the casing or enclosure which contains the parts of the piece and acts to protect the enclosed machinery. |
| Impellers | The rotating member of a fan, turbine, blower, axial or centrifugal pump, or mixing apparatus. Also known as a rotor. |

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| Insulation | A material providing high resistance to heat flow; usually made of mineral wool, cork, asbestos, foam glass, foamed plastic, diatomaceous earth, etc. fabricated in the form of batts, blankets, blocks, boards, granular fill and loose fill. |
| Joists | One of a series of parallel beams of timber, reinforced concrete, or steel used to support floor and ceiling loads, and supported in turn by larger beams, girders, or bearing walls; the widest dimension is vertically oriented. |
| Laminate | A product made by bonding together two or more layers of material. To unite layers of material with an adhesive. |
| Lateral Movement | A shifting in the direction of the side; on either side of the medial vertical plane. |
| Lens | A glass or plastic piece having smooth regular opposite surfaces, shaped to control transmitted light by refraction; used in a lighting unit to focus, disperse, or collimate light rays. |
| Level | A horizontal line or plane; especially such a plane taken as a basis for the measure of elevation. |
| Life Cycle | Under normal conditions, the expected life span based on proper installation and preventive maintenance. |
| Live Load | The moving or movable external load on a structure; includes the weight of furnishings, of the people, of equipment, etc. contained in a building, but does not include wind load. |
| Mar | To injure or damage so as to make imperfect or less attractive; spoil; impair; disfigure. |
| Mesh | A network of metal wires or the like. The number of openings per inch in wire cloth; (a 100-mesh screen has 100 openings per inch in each direction). Expanded metal, light woven steel or welded steel used as reinforcement in concrete. |
| Mobilization | To put into motion, to bring into readiness for immediate active service; to organize (people, resources, etc.) for active service or use. |
| Mulch | Material such as leaves, hay, straw, or the like, spread over the surface of the ground to protect the roots of newly planted shrubs, trees, or tender plants, etc. from the sun or cold. |

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| Nozzles | A tube-like device, usually streamlined, for accelerating and directing a fluid; whose pressure decreases as it leaves the device. |
| Parallel | Extending in the same direction and at the same distance apart at every point, so as never to meet, as lines, planes, etc. |
| Parasite | A plant or animal that lives on or in an organism of another species from which it derives sustenance or protection without benefitting the host and usually doing harm. |
| Pickets | A flat strip or slat or round stake, usually of wood; set in series to form a fence. An area enclosed by such stakes. |
| Pistons | A disk or short cylinder closely fitted in a hollow cylinder and moved back and forth by the pressure of a fluid so as to transmit reciprocating motion to the piston rod attached to it, or moved by the rod to exert pressure on the fluid. |
| Planks | A long, wide, square-sawn thick piece of timber; the specifications vary, but often the minimum width is eight inches and the minimum thickness is two to four inches. |
| Plaque | Any thin, flat, piece of metal, wood etc. with a picture, design in relief, etc. hung as on a wall for ornamentation. A wall tablet inscribed to commemorate an event or identify a building. |
| Plumb | Exactly vertical. |
| Pop-Outs | A conical fragment that has broken out of the surface of the concrete leaving small holes. Generally a shattered aggregate particle will be found at the bottom of the hole, with a part of the fragment still adhering to the small end of the pop-out cone. Pop-outs are caused by reactive aggregates and high alkali cement. They are also caused by aggregates such as shale, which expand with moisture. |
| Posts | Any stiff, vertical, more or less isolated upright; may be of wood, stone, metal, etc. may support a superstructure or afford a firm point of lateral attachment. |
| Precast Concrete | A concrete member that is cast and cured in other than its final position. |
| Radial | Branching in all directions from a common center. Having or characterized by parts that branch out in this way. |

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| Retaining Walls | A wall, either freestanding or laterally braced, that bears against an earth or other fill surface and resists lateral and other forces from the material in contact with the side of the wall. |
| Rot | Decomposition in wood by fungi and other microorganisms; reduces the strength, density, and hardness. |
| Scaling | The gradual and continuing loss of surface mortar and aggregate over an area; due to the failure of the cement paste caused by chemical attack or freeze/thaw cycles. |
| Sculpture | The art of carving wood, chiseling stone, casting or welding metal, modeling clay or wax, into three dimensional representations, as statues figures, forms, etc. |
| Seals | A tight closure as against the passing of air and water, something that closes or fastens tightly or securely. |
| Sediment | The matter which settles to the bottom of a water (or any other liquid) vessel. |
| Solenoid | An electrically energized coil of insulated wire which produces a magnetic field within the coil. In particular, a coil that surrounds a movable iron core which is pulled to a central position with respect to the coil when the coil is energized by sending current through it. |
| Solvent | A substance, usually liquid that dissolves or can dissolve another substance. |
| Sonic | Of or having to do with sound; designating or of a speed equal to the speed of sound. |
| Spalling | A roughly circular or oval depression in the concrete. Spalls result from the separation and removal of a portion of the surface concrete, revealing a fracture roughly parallel to the surface. Spalls can be caused by corroding reinforcement steel and friction from thermal movement; reinforcing steel is often exposed. |
| Structural Member | One of a number of units which when assembled together becomes an integral part of the entire building or structure. |
| Subside | To sink or fall to the bottom; settle as sediment. |
| Substrate | A part, substance, element, etc. which lies beneath and supports another; foundation; any basis or foundation. |

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| Topographic | The configuration of a surface including its relief and the locations of its natural and man-made features, usually recorded on a drawing showing surface variations by means of contour lines indicating height above or below a fixed datum. |
| Transit (N) | A surveying instrument used for the measurement and laying out of horizontal and vertical angles, distances, directions, and differences in elevation; a type of theodolite having an alidade with a telescope which can be reversed in direction. |
| Translucent | Descriptive of a material that transmits light but diffuses it sufficiently so that an image cannot be seen through the material clearly. |
| Treated Wood | Structural timber treated with preservatives to protect it from degradation by decay, fungi, insects, and marine borers. Preservatives are applied by non-pressure processes that provide superficial protection; and by pressure processes that force chemicals into the wood. |
| Triangulated | Having used a method of surveying in which the stations are points on the ground which are located at the vertices of a chain or a network of triangles; the angles of the triangles are measured instrumentally; then the sides are derived by computation from selected sides which are termed "base lines" the lengths of which are obtained from direct measurements on the ground. |
| Trusses | A structure composed of a combination of members, usually in some triangular arrangement so as to constitute a rigid framework. |
| Turf | The upper layer of earth and vegetable mold in which the roots of grass and other small plants form a thick cover. |
| Turnbuckle | A device for connecting and tightening a line, rod, or stay; consists of a right screw and a left screw which are coupled by means of a link. |
| Ultrasonic | Pertaining to signals, equipment, or phenomena involving frequencies just above the range of human hearing, hence about 20,000 hertz. |
| Vegetation | Plant life in general. |

APPENDIX B

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| Volume | The amount of space occupied in three dimensions; cubic contents; a large quantity, bulk. Any of a set making up a matched set or a complete work. |
| Wales | A horizontal timber or beam used to brace or support an upright member, as sheeting, formwork for concrete, etc.. |
| Weathering | Aging, deterioration, discoloration as a result of exposure to weather. |
| Weep Holes | Opening provided in a wall or bulkhead to facilitate the drainage of water. It usually serves to reduce hydrostatic pressure behind the structure. |
| Yardarm | A spar secured at its center to a flagpole to allow displaying more than one flag, banner, or emblem from the source flagpole. |

APPENDIX C

LIFE CYCLES**13 SITE WORK****13.01 FENCING**

| | |
|---------------|--------|
| Wood | 10 YRS |
| Metal | 20 YRS |
| Concrete | 30 YRS |
| Masonry/Stone | 30 YRS |

Source:

Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

13.02 RETAINING WALLS

| | |
|------------------|--------|
| Concrete | 40 YRS |
| Metal | 25 YRS |
| Wood | 15 YRS |
| Reinforced earth | 25 YRS |
| Masonry/stone | 30 YRS |

Source:

Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

13.03 FOUNTAINS AND POOLS

| | |
|----------------------|--------|
| Surface - vinyl | 20 YRS |
| Surface - concrete | 30 YRS |
| Surface - gunite | 30 YRS |
| Surface - metal | 20 YRS |
| Surface - tile | 30 YRS |
| Surface - fiberglass | 40 YRS |
| Pumps | 15 YRS |
| Motors | 15 YRS |
| Controls | 15 YRS |
| Water heaters | 15 YRS |
| Piping and fittings | 30 YRS |
| Valves | 15 YRS |
| Water filters | 15 YRS |
| Chlorinators | 15 YRS |
| Underwater lights | 10 YRS |

Source:

Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

APPENDIX C

13.04 DOMES (BULK STORAGE)

| | |
|----------|--------|
| Wood | 25 YRS |
| Metal | 20 YRS |
| Plastic | 20 YRS |
| Concrete | 40 YRS |

Source:

Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

13.05 CEMETERIES

Unlimited

Source: N/A

13.06 LANDSCAPING

| | |
|---------------------------------|---------|
| Topography | 100 YRS |
| Lawns, grasses and ground cover | 2 YRS |
| Shrubs and vines | 20 YRS |
| Trees | 30 YRS |
| Planting beds | 2 YRS |
| Sprinkler systems | 15 YRS |
| Irrigation systems | 5 YRS |

Sources:

Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

13.07 FLAGPOLES

| | |
|---------------|--------|
| Wood | 25 YRS |
| Metal | 30 YRS |
| Concrete | 30 YRS |
| Masonry/Stone | 30 YRS |

Source:

Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988

APPENDIX C

13.08 SIGNAGE

| | |
|---------------|--------|
| Wood | 10 YRS |
| Metal | 20 YRS |
| Concrete | 30 YRS |
| Masonry/Stone | 30 YRS |

Source:

Means Facilities Maintenance Standards, Roger W. Liska, PE, AIC, 1988